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THE PHILIPPINE JOURNAL OF SCIENCE

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THE NUTRITION OF FILIPINO STUDENT OFFICERS

By IGNACIO E. VILLANUEVA[1]

Of the Magnolia Dairy Products Company, Manila

Proper nutrition is necessary for health and efficiency. The present investigation is made on the nutrition of the student officers in the Reserve Officers Service School at Camp Henry T. Allen, Baguio, Mountain Province, Philippines.

Baguio is located at an elevation of nearly 5,000 feet and is very sanitary. It has a large, well-constructed market which is open every day. Fresh meats, fish, and many kinds of vegetables and fruits are usually on sale there.

During the week of October 9 to October 15, 1936, a study was made of the daily ration of the 174 student officers who ate at the Quezon Mess Hall. The average temperature of Baguio during this period was 16.6° C.

The weights and amounts of the food materials used daily for a period of seven days were recorded. The individual weights of the student officers were obtained from the Post Surgeon's Office. The average body weight of the students was 55.4 kilograms, and the distribution of body weights was as follows:

Percentage of students.	Average body weight. Kilos.
26.35	43–50
46.62	51–60
20.94	61–70
5.40	71–80
0.69	81–83

The maximum and minimum weights found were 83 and 43 kilograms respectively. The ages ranged from 22 to 46 years.

The results of this investigation are given in Tables 1 to 4.

[1] Formerly on active duty as Probationary Third Lieutenant, Philippine Army Reserve.

TABLE 1.—*Individual food intake per day of Filipino student officers.*

Date.	Proteins.	Fats.	Carbohydrates.	Ash.	Fuel value.
October, 1936	*g.*	*g.*	*g.*	*g.*	*Calories.*
9	229	280	383	29	5,063
10	150	288	303	19	4,885
11	152	108	868	24	5,193
12	148	136	551	22	4,118
13	170	165	679	29	5,098
14	80	69	445	12	2,711
15	234	193	430	31	3,762
Total	1,183	1,239	3,659	166	30,830
Average	169	177	522	23	4,404

Table 1 shows that the average individual intake per day of the student officers was as follows: Proteins, 169 grams; fats, 177 grams; carbohydrates, 522 grams; with a fuel value of 4,404 calories. The average ash consumption was only 23 grams.

Table 2 shows that the individual food intake of the student officers is relatively high compared to the individual intake of foreign armies. Generally, when the necessary funds are available, the Filipino diet consists of rice, fish, meat, fruits, and vegetables. Milk, although a rich food, is used only by the very few who have the means to purchase it.

TABLE 2.—*The individual food intake of Filipino student officers compared with those of other organizations.*

Countries.	Proteins.	Fats.	Carbohydrates.	Calories.
	g.	*g.*	*g.*	
British Home Ration (1918)	124.0	136.00	419.00	3,483
Canadian (1918)	107.0	118.00	344.00	2,946
French Normal March (1918)	138.0	98.00	467.00	3,604
Italian (1917)	127.0	38.00	469.00	2,797
United States (1921)	147.0	174.00	643.00	4,859
United States Training Camps	129.0	136.00	545.00	3,898
Philippine Constabulary[a]	116.9	14.23	579.41	3,731
Reserve Officers Service School	169.0	177.00	522.00	4,404

[a] Concepcion, I., Philip. Journ. Sci. 62 (1937) 89. All other data, given in the table were taken from L. R. Murlin and F. M. Hildebrandt, Amer. Journ. Physiol. 49 (1919) 531.

The protein intake was high, being 169 grams compared to 107 grams for the Canadians. The student officers had much more protein intake than those of the Philippine Constabulary (116.9 grams) as found by Concepcion. Fat was also very high,

about twice as much as the intake of the Philippine Constabulary and nearly six times as much as that of the Italians. The United States Army has the highest carbohydrate intake, 643 grams, with the Philippine Constabulary second and the student officers fourth. The Canadians have the lowest carbohydrate intake (344 grams). The diet of the Philippine student officers had a fuel value of 4,404 calories, next to that of the United States Army diet, which has 4,859. The Philippine Constabulary has a higher carbohydrate intake than have the student officers, but the latter exceed in proteins and fats, with a difference in fuel value of 673 calories.

The protein and fuel values per kilogram body weight, as compared with those given by Concepcion for the Philippine Constabulary, are shown in Table 3, which shows that the diet of the student officers has a higher fuel and protein value per kilogram body weight than the Constabulary and the United States Army Training Camps, with a difference of 12.03 and 20.80 calories for fuel values and 0.94 and 1.11 calories for proteins per kilogram body weight, respectively.

TABLE 3.—*Average weight and protein and calorific value per kilogram body weight of Filipino student officers as compared with similar data for other organizations.*

Organization.	Average weight.	Fuel value, in calories.		Protein, in calories.	
	kg.	*Total.*	*Per kg.*	*Total.*	*Per kg.*
Philippine Constabulary	55.3	3,731.21	67.47	116.9	2.11
United States Army Training Camp	66.4	3,898.00	58.7	219.0	1.94
Philippine Scouts	55.0	3.672.00	66.7		
Reserve Officers Service School	55.4	4.404.00	79.5	169.0	3.05

Table 4 shows the percentage distribution of nutrients in relation to calories as compared with the data obtained, and the recommendations made by previous investigators. In Table 4 33.82 per cent was the grain products and cereals consumption compared to 67.94 per cent found by Concepcion for the Constabulary rations. The results, however, are close to those of Rose for a moderate diet. Meat, fish, and eggs constitute more than twice the Constabulary ration and Concepcion's recommendation for low-cost diet. Milk and dairy products are very low, only 2.08 per cent. During the early days of training there was a large supply of milk, but when it was found that a financial deficit was likely to occur the milk was reduced in order

that the mess allowance could conform to the allowance for each student officer.

TABLE 4.—*Percentage distribution of nutrients in relation to calories as compared with those recommended by previous workers.*

Food materials.	Moderate (Rose).	Recommended by Concepcion for low-cost diet.	Concepcion's Constabulary ration.	Reserve Officers Service School.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
Grain products or cereals	30	50	67.94	33.82
Meat, fish, and eggs	15	10	10.40	24.57
Milk and dairy products	13	10	2.30	2.08
Fruits and vegetables	15	17	7.40	16.83
Fatty foods and cereals	27	13	4.60	18.16
Sugar and sweets	----------	----------	6.8	----------
Miscellaneous	----------	----------	0.56	4.54

The writer is in accord with the recommendations of Concepcion that an additional allowance be made for the student officers and the Constabulary to overcome the existing calcium and phosphorus deficiency in the diets of these organizations.

Although the percentage of fatty foods was much higher than recommended by Concepcion, it falls below the percentage recommended by Rose.

SUMMARY

A dietary study was made of the food served the Filipino Student Officers at the Reserve Officers Service School at Camp Henry T. Allen, Baguio.

This investigation was conducted for seven days.

There were 174 individuals of various body weights, with an average weight of 55.4 kilograms, and their ages ranged from 22 to 46 years.

The average individual intake per day as found was as follows: 169 grams proteins, 177 grams fats, 522 grams carbohydrates, 23 grams ash, and a fuel value of 4,404 calories.

When the officers do extensive muscular work and a greater fuel value is needed they should be given more carbohydrate foods.

More milk should be given to the officers. The importance of this food lies in the fact that it is a source of proteins, minerals, and vitamins.

Meat, fish, and eggs should be served as often as possible, provided they are cooked variably. The diet should be made palatable, efficient, and reasonably inexpensive.

As compared with that of other organizations, it appears that the food served at the Reserve Officers Service School in Baguio is of fair quality.

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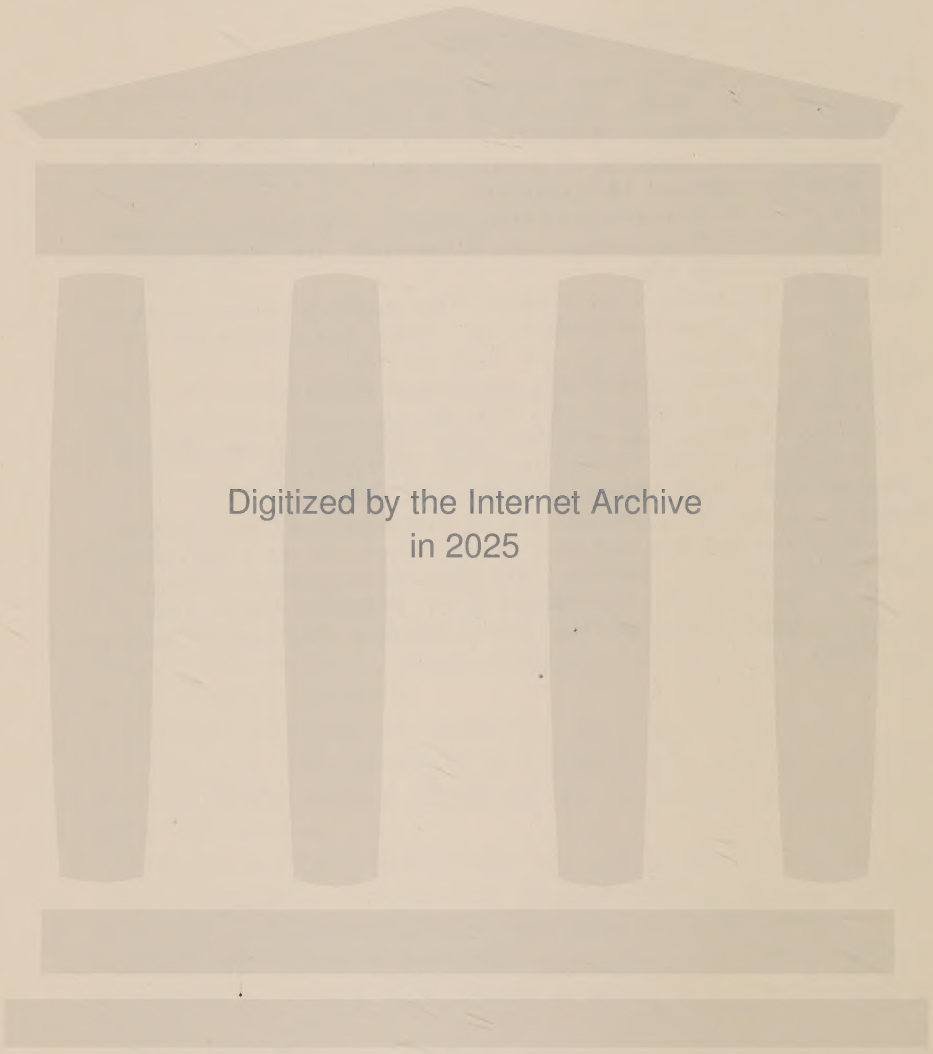

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THE SYSTEMATIC POSITION OF SOME TREMATODES REPORTED FROM THE PHILIPPINES

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THREE TEXT FIGURES

Among the trematodes reported from the Philippines by Tubangui (1933) and Africa and Garcia (1935) are some species the systematic status of which has been open to question. For this reason it was decided to study again their morphology so that their systematic relationships may be better established.

Family MICROPHALLIDÆ Travassos, 1920

Genus SPELOTREMA Jaegerskioeld, 1901

SPELOTREMA BREVICÆCA (Africa and Garcia, 1935) comb. nov. Text fig. 1.

Synonym.—Heterophyes brevicæca Africa and Garcia, 1935.

This trematode is considered a dangerous parasite of man, its eggs having been found by Africa and his collaborators (1935, 1936, 1937) associated with lesions in the heart, brain, and spinal cord of persons who died of acute cardiac dilatation. Recently it was encountered by one of us (C. M. A.) in the intestine of a bird (*Sterna albifrons sinensis*).

The fluke presents several morphological features which are not encountered among the established members of the genus *Heterophyes* Cobbold. The examination of a large number of stained specimens has shown among other things the absence of a receptaculum seminis, and this fact alone would exclude the parasite from the family Heterophyidæ, as the latter has been defined by Witenberg (1929). In that respect as well as in the location of the genital glands, the absence of a gonotyl, and the possession of short intestinal cæca, it resembles another group of flukes represented by the genera *Levinseniella* Stiles and Has-

sall, 1901, *Spelotrema* Jaegerskioeld, 1901, and *Spelophallus* Jaegerskioeld, 1908. The status of these three genera, which seem to differ from each other mainly in the structure of the terminal portions of the genitalia, does not appear to have been fully established; but relying on their being independent zoölogical units we refer the trematode in question to the genus *Spelotrema* because of its great similarity to the members of the latter.

The position of *Spelotrema* and related genera in the scheme of classification of the trematodes has been a matter of uncertainty. Some writers have classified them together with *Microphallus, Maritrema,* and *Monocæcum,* under the subfamily Microphallinæ of the Heterophyidæ; while others have removed these different genera from the heterophyids and placed them in a separate family, the Microphallidæ. According to Mueller and Van Cleave (1932), however, "Until the detailed morphology of Levinseniella, Spelotrema, Spellophallus, Monocæcum and Maritrema has been determined as compatible with that of Microphallus, these genera should be excluded from the Microphallidae, though Poche (1926: 151) has attempted to relate them to the subfamily Microphallinae." Recently Rothschild (1937) studied the excretory system of a species of *Maritrema* and observed that it corresponds with that of *Microphallus* and allied genera. On the basis of our interpretation of the anatomy of *Spelotrema brevicæca* we have included *Spelotrema* in the family Microphallidæ because it agrees with *Microphallus* in many important points, such as the absence of a gonotyl, a cirrus pouch, and a seminal receptacle, and the general plan of the main excretory system.

Description.—Spelotrema: Body pyriform to triangular in outline, thinner anteriorly than posteriorly, 0.5 to 0.7 by 0.3 to 0.4 millimeter; in preserved specimens dorsal surface convex, ventral surface concave, with acetabulum prominently elevated. Cuticle armed with scalelike spines from anterior end to posterior level of vitellaria. Oral sucker subterminal, 0.065 to 0.095 millimeter in diameter; acetabulum slightly larger than oral sucker, 0.080 to 0.105 millimeter across, at middle of body length or behind that level in well-extended specimens. Prepharynx very short, in most specimens practically absent; pharynx 0.032 to 0.034 by 0.034 to 0.043 millimeter; œsophagus 0.08 to 0.09 millimeter long, with relatively thick walls but narrow lumen; intestinal cæca wide in diameter but short, only 0.15 to 0.19 millimeter long, not reaching posteriorly beyond middle

level of acetabulum. Genital pore near left margin of acetabulum, communicating with a small genital sinus.

Testes globular to oval, postovarial, 0.052 to 0.075 by 0.067 to 0.094 millimeter, with zones coinciding and fields widely separated, one on each side of body behind level of acetabulum, and more or less completely concealed in ventral view by anterior

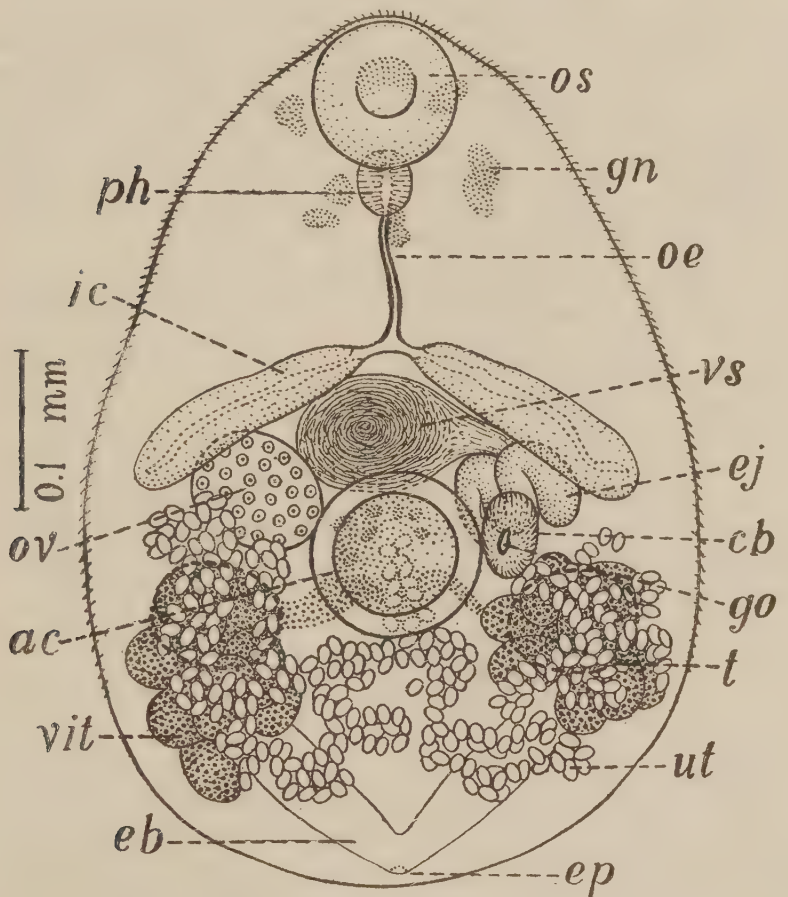

FIG. 1. *Spelotrema brevicæca* (Africa and Garcia, 1935). Entire worm, ventral view.

vitelline follicles and uterus. Seminal vesicle large, pyriform, 0.090 to 0.110 by 0.055 to 0.075 millimeter, crowded in between intestinal cæca and acetabulum and slightly overlapped by latter; in contracted specimens it is displaced posteriorly, dorsal to acetabulum. Seminal vesicle followed by a short prostate and then a long coiled ejaculatory duct which opens into a genital sinus through the apex of a muscular, cone-shaped body (kegel-

förmiger Körper) that measures 0.037 to 0.045 by 0.030 to 0.034 millimeter.

Ovary slightly oval, usually a trifle larger than testes, 0.052 to 0.098 by 0.067 to 0.105 millimeter, at or near middle of body length, on right side of median line, between acetabulum, right intestinal cæcum, and right testis. Seminal receptacle absent. Uterus moderately long, loosely coiled, mostly postacetabular, its terminal portion (metraterm) opening into genital sinus near base of conical body and to left of male genital opening. Vitellaria prominent, mostly posttesticular, follicular. consisting of two groups of 7 to 9 (usually 8) oval to roundish follicles each. Small vitelline reservoir and shell gland median, immediately behind acetabulum. Eggs small, yellowish, operculated, 15 to 16 by 9.4 to 10 microns.

Excretory pore dorsoterminal at posterior end of body; excretory bladder V-shaped, its branches reaching anteriorly to level of acetabulum.

Hosts.—Man and the bird, *Sterna albifrons sinensis* Gmelin.

Location.—Intestines.

Locality.—Manila, Philippines.

Compared with the members of the genus *Spelotrema* listed by Jaegerskioeld (1908), the Philippine parasite appears to be most closely related to *Spelotrema similis*. It may be distinguished from the latter by its shorter œsophagus, greater number of vitelline follicles, and smaller eggs.

Family HETEROPHYIDÆ Odhner, 1914

Genus HETEROPHYOPSIS novum

HETEROPHYOPSIS EXPECTANS (Africa and Garcia, 1935) comb. nov. Text fig. 2.

Synonym.—*Heterophyes expectans* Africa and Garcia, 1935.

This trematode was originally reported from dogs. Recently it was found by one of us (M. A. T.) in the small intestine of a bird, *Fregata ariel ariel* (G. R. Gray), which was caught in Obando, Bulacan Province, Luzon, and obtained for dissection through the courtesy of Dr. C. Manuel, of the Fish and Game Administration Division of the Bureau of Science. By means of feeding experiments with young dogs, it was determined by Vasquez-Colet and Africa (1938) that the parasite utilizes several species of marine fishes as second intermediate hosts.

In their original description Africa and Garcia (1935) called attention to a number of morphological features which separate this fluke from the established members of the genus

Heterophyes; namely, the relative position of the testes, the location of the vitellaria and acetabulum, and the number of hooks found on the gonotyl. To these should be added the extent of the uterus which is not confined between the testes and the acetabulum, as is the case in members of the genus *Heterophyes,* but passes posteriorly beyond the testes to near the posterior end of the body; and the shape of the excretory bladder which has a long S-shaped stem, instead of a short one as found in *Heterophyes.* We consider these differences to be of more than specific importance, and for this reason we propose the new genus *Heterophyopsis* for the trematode in question.

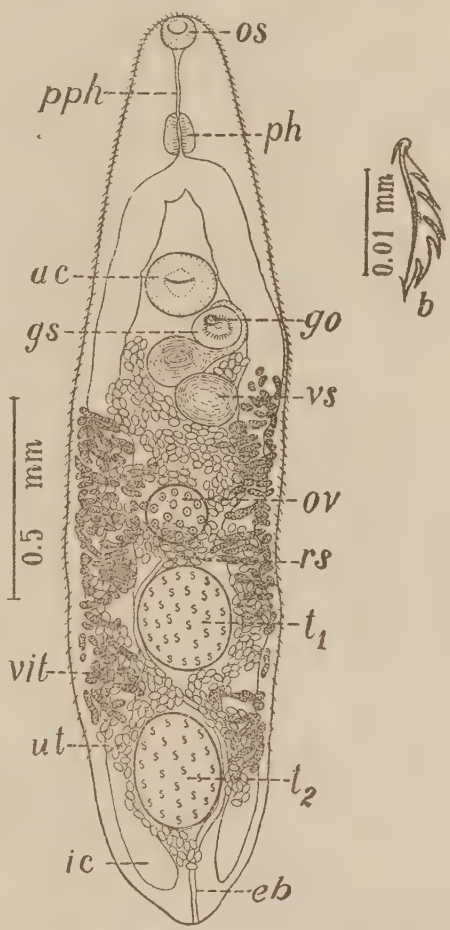

FIG. 2. *Heterophyopsis expectans* (Africa and Garcia, 1935). *a,* Entire worm, ventral view; *b,* one of the spines on the gonotyl.

Generic diagnosis.—Heterophyidæ: Body elongate. Prepharynx well marked; œsophagus very short or absent; intestinal cæca long, reaching to near posterior end of body. Acetabulum in anterior third of body length. Genital sac independent of ventral sucker, sinistral, alongside posteroexternal border of acetabulum; gonotyl disc-shaped, occupying the whole of genital sac and armed with a circlet of serrated spines. Testes in posterior portion of body, in a straight line or one slightly obliquely behind the other. Ovary median, pretesticular, equatorial. Seminal vesicle large, immediately behind genital sac, constricted into at least two portions. Seminal receptacle behind ovary. Uterus long, loosely coiled, between genital sac

and posterior end of body. Vitellaria mostly lateral, between seminal vesicle and second testis. Excretory bladder with a long S-shaped stem and two short branches. Adults in intestines of birds and mammals.

Type species.—Heterophyopsis expectans (Africa and Garcia, 1935).

Description of type species.—Heterophyopsis: Body 1.5 to 2.2 millimeters in length by 0.3 to 0.5 millimeter in maximum width across ovary. Cuticular spines thickly-set anteriorly, scantier after middle of body length, finally disappearing near posterior end. Oral sucker 0.06 to 0.09, acetabulum 0.11 to 0.17 millimeter in diameter, the latter at posterior portion of anterior third of body length. Prepharynx 0.11 to 0.27 millimeter long; pharynx 0.06 to 0.09 by 0.05 to 0.07 millimeter; œsophagus from very short, practically absent, to 0.06 millimeter long; intestinal cæca reaching to near posterior end of body.

Genital pore immediately behind acetabulum, to left side of median line, at tip of gonotyl which measures 0.08 to 0.10 by 0.08 to 0.13 millimeter and is provided with a circlet of serrated spines about 15 microns long.

Testes roundish to oval, median, postovarial, one immediately behind the other in a straight line or a little obliquely; anterior testis 0.12 to 0.27 by 0.12 to 0.22, posterior testis 0.13 to 0.29 by 0.11 to 0.22 millimeter. Seminal vesicle median, prominent, constricted near middle of its length into two portions; prostate short; ejaculatory duct narrow, passing anteriorly around left border of genital sac, then bending posteriorly towards genital pore.

Ovary globular, median, at or near middle of body length, 0.09 to 0.16 millimeter in diameter. Receptaculum seminis almost as large as ovary when well distended with spermatozoa, median or sometimes displaced to either side of median line. Uterus moderately long. Vitellaria consisting of irregularly shaped follicles arranged in two lateral bands and extending from level of seminal vesicle to as far as middle level of second testis. Transverse vitelline ducts meeting dorsal to ovary to form a small vitelline reservoir. Shell gland dorsal to ovary and slightly anterior to it. Eggs oval, yellowish, thick-shelled, with a slight "shouldering" at opercular end, 22.5 to 26.3 by 14 to 18 microns.

Excretory pore terminal at posterior end; excretory bladder with a long S-shaped stem which divides into two short branches behind ovary.

Hosts.—Dog and the bird, *Fregata ariel ariel* (G. R. Gray).
Location.—Small intestine.
Localities.—Manila; Obando, Bulacan Province, Luzon.

Genus GALACTOSOMUM Looss, 1899

GALACTOSOMUM ANGUILLARUM (Tubangui, 1933) comb. nov. Text fig. 3.

Synonym.—Haplorchis anguillarum Tubangui, 1933.

Chen (1936) has called attention to the systematic status of this trematode which, according to him, does not belong in the genus *Haplorchis* Looss, 1899. A reëxamination of the original side and its comparison with the different members of the famly Heterophyidæ has shown that Chen is correct in his contention and that the parasite has closer affinity with species of the genus *Galactosomum* Looss, 1899, than with those of *Haplorchis*.

It may be of interest to note that *Galactosomum anguillarum* is the second sexually immature heterophyid to be recorded from the intestines of fishes, the other one being *Apophallus americanus* Van Cleave and Mueller, 1932. Although Mueller and Van Cleave (1932) have described a number of adult heterophyids belonging to distinct genera from fishes, it is doubtful if species of *Galactosomum* and *Apophallus* can develop into full maturity in this group of hosts.

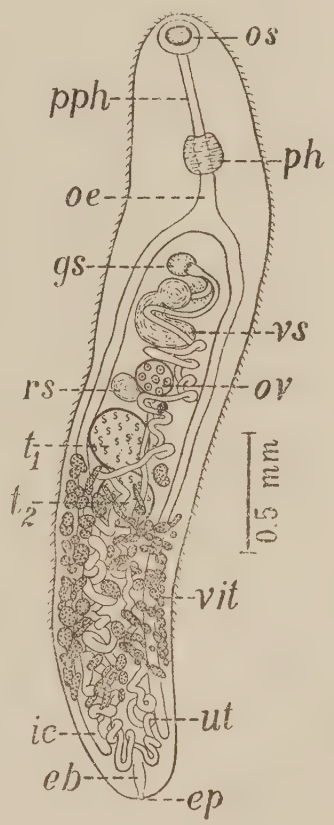

FIG. 3. *Galactosomum anguillarum* (Tubangui, 1933). Entire worm, ventral view.

Description.—Galactosomum: Body elongate, 2.9 by 0.56 millimeters. Cuticle armed with numerous small spines from anterior end to level midway between second testis and posterior end of body. Oral sucker 0.15 by 0.18 millimeter; acetabulum absent. Prepharynx 0.34 millimeter long; pharynx 0.14 by 0.16 millimeter; œsophagus 0.18 millimeter long; intestinal cæca reaching to about 0.2 millimeter from posterior end of body.

Genital pore median, behind œsophageal bifurcation, at junction of anterior and middle thirds of body length. Genital sac occupied wholly by pyriform gonotyl measuring 0.10 by 0.13 millimeter and armed with five stout hooks.

Testes roundish in outline, postovarial, one immediately but somewhat obliquely behind the other; anterior testis 0.26, posterior testis 0.24 millimeter in diameter. Seminal vesicle median, between gonotyl and ovary, 0.42 by 0.13 millimeter, bent and constricted at anterior third of its length into two unequal portions. Prostate short, followed by equally short ejaculatory duct.

Ovary median, slightly oval and compressed, immediately preequatorial, 0.14 by 0.17 millimeter. Oviduct arising from posterior border of ovary. Receptaculum seminis well developed, immediately behind ovary and to right side of median line. Vitellaria moderate, meeting in median line and extending from posterior level of first testis to in front of blind ends of intestinal cæca. Vitelline reservoir and shell gland behind ovary, alongside seminal receptacle. Uterus moderately long, mostly posttesticular, arranged in short descending and ascending coils, and reaching posteriorly beyond terminations of cæca. No eggs present.

Excretory pore posteroterminal; excretory bladder Y-shaped.

Host.—*Anguilla mauritiana* (Bennet).

Location.—Intestine.

Locality.—Palo, Leyte.

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ILLUSTRATIONS

TEXT FIGURES

[Abbreviations: *ac*, Acetabulum; *cb*, cone-shaped body (genital papilla); *eb*, excretory bladder; *ej*, ejaculatory duct; *ep*, excretory pore; *gn*, nerve ganglion; *go*, genital opening; *gs*, genital sac; *ic*, intestinal cæcum; *oe*, œsophagus; *os*, oral sucker; *ov*, ovary; *ph*, pharynx; *pph*, prepharynx; *rs*, seminal receptacle; *t*, testis; *ut*, uterus; *vit*, vitelline glands; *vs*, seminal vesicle.]

FIG. 1. *Spelotrema brevicæca* (Africa and Garcia, 1935). Entire worm, ventral view.

2. *Heterophyopsis expectans* (Africa and Garcia, 1935). *a*, Entire worm, ventral view; *b*, one of the spines on the gonotyl.

3. *Galactosomum anguillarum* (Tubangui, 1933). Entire worm, ventral view.

NEW OR LITTLE-KNOWN TIPULIDÆ FROM EASTERN ASIA (DIPTERA), XL

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THREE PLATES

The crane flies discussed in the present report are all from northern Korea (Chosen), where they were collected by Mr. Alexander Yankovsky, well-known entomologist and naturalist. The materials included are from a variety of localities that may be grouped under the following four major categories:

OMPO, altitude 120 to 2,000 feet; average, 600 to 800 feet.

MOUNT CHONSANI (Chonsany), Paiktusan, on the border of Manchuria, altitude 3,000 to 5,100 feet, July 12 to 26, 1937.

SEREN MOUNTAINS, 30 miles above the Ompo River, altitude 2,100 to 6,200 feet.

YANCHEN LAKE, 80 miles northeast of Ompo, altitude 30 to 65 feet.

I wish to express my very deep gratitude to Mr. Yankovsky for the time and care that he has devoted to the collecting of the Korean Tipulidæ. All types are preserved in my collection of these flies. I am including in this report a few species of the families Tanyderidæ and Trichoceridæ, commonly called crane flies though not belonging to the restricted family Tipulidæ.

TANYDERIDÆ

PROTANYDERUS YANKOVSKYI sp. nov. Plate 1, fig. 1.

Large (wing, 14 millimeters or more); antennal flagellum yellow; mesonotal præscutum gray, with four poorly defined more brownish stripes; scutellum testaceous yellow; knobs of halteres dark brown; femora yellow, tips blackened, tibiæ and tarsi black; wings whitish subhyaline with four brown crossbands, the three outer crossbands interconnected by the uniformly brown cell R_4; abdomen with basal five segments brown or yellowish brown, the outer segments, including male hypopygium, black; dististyle of male hypopygium simple.

Male.—Length, about 13 millimeters; wing, 14.

Female.—Length, about 13 millimeters; wing, 14.5.

Rostrum black, a little shorter than remainder of head not including the brown porrect labial palpi; maxillary palpi black. Antennæ relatively short, 16-segmented; scape dark brown, pruinose; pedicel dark, flagellum yellow; flagellar segments cylindrical, longest verticils a little exceeding segments. Head gray; a low darkened tubercle on anterior vertex behind antennal fossa; posterior vertex a little darker.

Cervical sclerites dark brown. Pronotum gray. Mesonotal præscutum gray with four poorly defined, more brownish stripes; setigerous punctures of interspaces somewhat conspicuous; scutal lobes darkened, pruinose, median area and scutellum testaceous yellow; parascutella dark; mediotergite brown. Pleura chiefly dark brownish gray, variegated by paler gray. Halteres with stem yellow, knob dark brown. Legs with coxæ and trochanters yellow; femora yellow, tips passing into black, a little more extensive on fore femora where it includes about distal fifth; tibiæ and tarsi black. Wings (Plate 1, fig. 1) with ground color whitish subhyaline, prearcular and subcostal fields more cream-yellow; a very heavy brown pattern, distributed as follows: Cell C; four complete crossbands, the first postarcular, including basal portion of cell Cu and axillary region of anal cell; second band at cord, widened posteriorly in cells Cu and A; third band at level of fork of R_{2+3} and outer end of cell 1st M_2, more expanded at posterior border; last band apical, involving cells Sc_2 to M_1 inclusive; cell R_4 uniformly darkened, interconnecting the three outer crossbands; a major isolated dark area at origin of Rs and adjoining portion of cell Sc; a small marginal spot at end of vein M_2; veins yellow, darker in clouded areas. Venation: Cell R_2 subequal in length to its cell; cell 1st M_2 longer than any of veins beyond it.

Abdomen with basal five segments brown to yellowish brown; remaining segments, including male hypopygium, black; ovipositor small, orange. Male hypopygium with dististyle relatively long and slender, gradually narrowed outwardly.

Habitat.—Northern Korea.

Holotype, male, Chonsani, Paiktusan, altitude 4,300 feet, July 12, 1937 (*Yankovsky*). Allotopotype, female.

I name this striking species in honor of the collector, Mr. Alexander Yankovsky. The fly is very distinct from the five other members of the genus so far made known. The four Asiatic species of *Protanyderus* may be separated by the following key.

Key to Asiatic species of Protanyderus.

1. Very large (wing, 14 millimeters or more); wings with four brown crossbands, second crossband, at cord, to fourth, at apex, interconnected by uniformly darkened cell R_4 (northern Korea).
P. yankovskyi sp. nov.

Small (wing, under 10 millimeters); wings with crossbands, if present, narrow, not interconnected along cell R_4; interspaces, especially cell C, broken by additional spots and dots ..... 2.

2. Very small (wing, male, about 6.5 to 7 millimeters); wing pattern chiefly dotted and spotted, including a series of spots in cell M adjoining vein Cu (Turkestan) ..... *P. beckeri* (Riedel).

Larger (wing, male, about 8 to 9 millimeters); wing pattern crossbanded, interspaces with restricted dots and spots; dark area at origin of Rs interconnected across cell M with darkened cloud in cells Cu and A, forming a complete oblique crossband near wing base; a continuous dark band along vein Cu, connecting basal two dark fasciæ ..... 3.

3. Wings (male) narrow, not conspicuously widened opposite termination of vein A; cells M_1 and 2d M_2 at margin moderately wide, subequal to cell M_3; ædeagus with median branch much smaller than others, subatrophied (Japan; Kiushiu; Manchuria) ..... *P. esakii* Alexander.

Wings (male) broad, especially opposite termination of vein A; cells M_1 and 2d M_2 very wide at margin, much more extensive than cell M_3; ædeagus with all three branches elongate and subequal (Japan; Honshiu) ..... *P. alexanderi* Kariya.

TRICHOCERIDÆ

TRICHOCERA TUBERCULIFERA sp. nov. Plate 1, fig. 2; Plate 2, fig. 25.

Belongs to *major* group; general coloration of mesonotum reddish brown, præscutum with a broad, darker brown, median stripe that is more or less divided by a central pale vitta; legs dark brown; wings with a strong brown tinge, stigma slightly darker; abdomen dark brown; male hypopygium with ventromesal lobes of basistyles not forming a continuous bridge; dististyle with a strong tubercle on mesal face at base; gonapophyses fused into a depressed median phallosome, lateral horns strongly divergent.

Male.—Length, about 7 to 7.5 millimeters; wing, 8 to 8.5.

Female.—Length, about 7.5 millimeters; wing, 8.5.

Rostrum dark brown; palpi black. Antennæ black, pedicel obscure yellow. Head dark brownish gray; vertex broad.

Mesonotum pale reddish brown, sparsely pruinose, with a broad, darker brown to brownish black median stripe that is more or less completely split by a central pale vitta; posterior sclerites of notum paler brown to brownish yellow. Pleura pale brown. Halteres dark brown, base of stem restrictedly yellow.

Legs with coxæ obscure yellow, base of fore coxæ more darkened; trochanters yellow; remainder of legs dark brown. Wings (Plate 1, fig. 2) with a strong brown tinge, the slightly darker stigma lying beyond level of R_2; prearcular field a trifle brighter; veins dark brown. Venation: R_{2+3+4} subequal to or a little shorter than R_{2+3}.

Abdomen dark brown throughout. Male hypopygium (Plate 2, fig. 25) with ventromesal lobes of basistyles, *b*, not forming a continuous bridge, touching at midline. Dististyle, *d*, of moderate length, with a low conspicuous tubercle on mesal face at base. Gonapophyses fused into a depressed median phallosome, *p*, as in the group, lateral horns strongly divergent, apex between horns gently convex. Ovipositor with cerci of moderate length, relatively slender, especially on distal half.

Habitat.—Northern Korea.

Holotype, male, Seren Mountains, altitude 5,000 feet, October 3, 1937 (*Yankovsky*). Allotopotype, female. Paratopotypes, 2 males.

I propose the name *major* for the group of species having the gonapophyses fused into a single depressed-flattened median plate, with their apices protruding laterad or caudad as strong horns. In the majority of species in this group the ventromesal lobes of the basistyles are fused at midline to form a continuous bridge. Three of the species, *Trichocera major* Edwards (northern Europe), *T. longisetosa* Alexander (western United States) and *T. setosivena* Alexander (Alaska) have simple dististyles, while *T. siberica* Edwards (northern and northeastern Asia) and *T. bituberculata* Alexander (Alaska) each have two unusually conspicuous lobes on each dististyle. The present fly is readily told from all these allied forms by possessing a single small basal tubercle on the relatively short dististyle.

TRICHOCERA SIBERICA Edwards.

Trichocera siberica EDWARDS, Ann. & Mag. Nat. Hist. IX 5 (1920) 431.

The unique type, a male, was from Verschininsk, Yenesei River, Siberia, 69° 5′ north latitude, some 3,000 miles northwest of the station here recorded. Seren Mountains, northern Korea, altitude 5,000 feet, October 3, 1937 (*Yankovsky*), males and females. The female, characterized here as allotype, differs, from the male only in sexual characters. The ovipositor has the cerci relatively elongate, only gently curved, the ventral edge nearly straight, the dorsal margin very gently curved.

TRICHOCERA MIRABILIS Alexander.

Trichocera mirabilis ALEXANDER, Philip. Journ. Sci. 55 (1934) 20, 21.

The types were from Kongo San, Korea, taken in October by Machida. NORTHERN KOREA, Yanchen, altitude 40 feet, October 6, 1937. OMPO, altitude 600 feet, November 17, 1937. SEREN MOUNTAINS, altitude 1,800 feet, October 13, 1937 (*Yankovsky*).

TRICHOCERA LATILOBATA sp. nov. Plate 1, fig. 3; Plate 2, fig. 26.

General coloration dark blackish gray, præscutum with two still darker submedian stripes; legs brownish black; wings grayish subhyaline, prearcular field more whitened; stigma and a small cloud on r-m pale brown; R_{2+3+4} longer than R_{2+3}; abdomen, including hypopygium, brownish black; male hypopygium with bridge of basistyles entire; dististyle relatively short and flattened, on mesal face beyond base with a broad-based triangular lobe.

Male.—Length, about 5 millimeters; wing, 5.5.

Rostrum and palpi black. Antennæ black, outer segments paler. Head brownish black.

Mesonotal præscutum dark blackish gray with two still darker submedian stripes; posterior sclerites of notum blackened, sparsely pruinose, posterior border of scutellum somewhat paler. Pleura brownish black, including dorsopleural membrane. Halteres infuscated, base of stem yellow. Legs with fore coxæ brownish black, middle coxæ testaceous, hind coxæ yellow; trochanters yellow; remainder of legs brownish black, extreme femoral bases yellow. Wings (Plate 1, fig. 3) grayish subhyaline, prearcular field more whitened; stigma and a small cloud on r-m pale brown; veins brown. Venation: R_{2+3+4} longer than R_{2+3}; vein 2d A somewhat angularly bent on distal third.

Abdomen, including hypopygium, brownish black. Male hypopygium (Plate 2, fig. 26) with ventromesal lobes of basistyles, *b*, forming a continuous bridge. Dististyle, *d*, relatively short and flattened, on mesal face beyond base with a broad-based triangular lobe. Gonapophyses, *g*, long and slender.

Habitat.—Northern Korea.

Holotype, male, Ompo, altitude 650 feet, August 11, 1937 (*Yankovsky*).

Trichocera latilobata is readily told from the other described species of the genus by the continuous bridge of the basistyles, in conjunction with the position and shape of the lobe on the mesal face of the dististyle. In other species with a simple lobe

on the mesal face of the dististyle, this is much smaller and nearly basal in position.

TIPULIDÆ

LIMONIINÆ

LIMONIINI

LIMONIA (LIMONIA) VENERABILIS sp. nov. Plate 1, fig. 4; Plate 2, fig. 27.

General coloration black; antennæ black throughout; halteres brownish black, base of stem pale yellow; femora pale brown, narrowly blackened close to tips; tibiæ and tarsi black; wings with a brownish tinge, oval stigma darker brown; R_{2+3} subequal to R_{1+2}; abdomen brownish black, caudal margins of segments narrowly paler; male hypopygium with ninth tergite very extensive; mesal-apical lobe of gonapophysis unusually long and slender, gently curved, tips a little expanded, terminating in a black spine.

Male.—Length, about 10 millimeters; wing, 10.

Rostrum and palpi black. Antennæ black throughout; flagellar segments passing through oval to elongate-cylindrical, with unusually long verticils. Head dark gray; anterior vertex moderately wide, about twice diameter of scape.

Pronotum brownish black, with coarse erect setæ. Mesonotal præscutum and scutum black, setæ of interspaces sparse but long and conspicuous; median area of scutum and scutellum paler than remainder; postnotum black, heavily pruinose. Pleura black, sparsely pruinose; dorsopleural membrane dark. Halteres brownish black, base of stem pale yellow. Legs with fore coxæ black, midcoxæ brown, posterior coxæ brownish yellow; trochanters yellow; femora pale brown, narrowly brighter basally, narrowly blackened close to tips, extreme apices pale; tibiæ and tarsi black; claws long, with an elongate median spine and smaller, more basal teeth. Wings (Plate 1, fig. 4) with a brownish tinge; stigma oval, darker brown; outer radial cells vaguely darker than remainder of ground; cord narrowly and insensibly darker; a dark cloud along vein Cu; veins brown, paler in prearcular field. Venation: Sc_1 ending about opposite one-third length of Rs, Sc_2 longer; R_{2+3} subequal to R_{1+2}; m-cu at fork of M.

Abdomen brownish black, caudal borders of sternites paler, obscure yellow, caudal borders of tergites more narrowly and less distinctly so; hypopygium black, tips of dististyles yellow. Male hypopygium (Plate 2, fig. 27) with tergite, 9*t*, unusually

extensive, divided into three parts by longitudinal lines, median section with caudal border very weakly emarginate. Basistyle, *b*, with ventromesal lobe low. Dististyle, *d*, with basal half darkened, moderately enlarged, with long coarse setæ; distal half narrowed, yellow. Gonapophysis, *g*, with mesal apical lobe unusually long and slender, gently curved, tips a little expanded, terminating in a black spine. Ædeagus, *a*, narrow, terminating in two short divergent points, surface with microscopic acute spicules, more concentrated down median line.

Habitat.—Northern Korea.

Holotype, male, Ompo, altitude 600 feet, June 23, 1937 (*Yankovsky*).

Limonia (*Limonia*) *venerabilis* is most similar to *L.* (*L.*) *pullata* Alexander and *L.* (*L.*) *tristina* Alexander, differing in the coloration, details of venation, and the structure of the male hypopygium, especially the unusually long slender lobe of the gonapophysis.

LIMONIA (DICRANOMYIA) MESOSTERNATA (Alexander).

Dicranomyia mesosternata ALEXANDER, Ann. Ent. Soc. America 12 (1919) 329, 330.

Northern Korea, Ompo, altitude 700 to 900 feet, October 26, 1937 (*Yankovsky*).

LIMONIA (DICRANOMYA) SPARSA (Alexander).

Dicranomyia sparsa ALEXANDER, Philip. Journ. Sci. 24 (1924) 544, 545.

Northern Korea, Ompo, altitude 120 to 160 feet, June 9 to 15, 1937 (*Yankovsky*). The type was from Saghalien.

LIMONIA (DICRANOMYIA) INFENSA sp. nov. Plate 1, fig. 5; Plate 2, fig. 28.

General coloration obscure brownish yellow, præscutum with three darker brown stripes; antennæ dark brown; pleura yellow; halteres pale, knob darkened at apex; femora yellow, tips very narrowly blackened; tibiæ yellow, extreme base narrowly darkened; wings cream-yellow, with a relatively heavy dark pattern, including four costal areas, last at stigma; Sc_2 far removed from the tip of Sc_1, at near midlength of vein Sc; m-cu shortly before fork of M; abdominal tergites brownish black, sternites obscure yellow; male hypopygium with rostral spines two, placed close together on short stout prolongation.

Male.—Length, about 6.5 to 8 millimeters; wing 7 to 9.

Rostrum brown; palpi black. Antennæ dark brown; flagellar segments oval, incisures well marked; two last segments sub-

equal in length. Head dark brownish gray, paler behind; anterior vertex moderately wide.

Mesonotal præscutum obscure brownish yellow, with three darker brown stripes, in cases the surface more heavily pruinose to obscure these stripes; scutal lobes darkened, median area abruptly paler, more pruinose; scutellum darkened medially, paler on sides; mediotergite darkened. Pleura yellow, more pruinose in more heavily patterned specimens, somewhat darker along suture between anepisternum and sternopleurite. Halteres pale, apex of knob darkened. Legs with coxæ and trochanters pale; femora yellow, tips very narrowly but conspicuously blackened, the amount subequal on all legs; tibiæ yellow, bases very narrowly darkened; tarsi yellow, outer segments passing into black. Wings (Plate 1, fig. 5) cream-yellow, heavily patterned with brown, including four costal areas, last largest, at stigma, confluent with a seam along cord; third area large, involving both tip of Sc and origin of Rs; second major area at Sc_2; basal area smallest; cord and outer end of cell 1st M_2 narrowly seamed with brown; wing tip in outer radial field very narrowly and insensibly seamed with brown; veins yellow, darker in clouded areas. Venation: Sc_1 ending opposite or just beyond origin of Rs, Sc_2 far from its tip, at near middistance between arculus and origin of Rs; m-cu shortly before fork of M; cell 2d A wide.

Abdominal tergites brownish black, sternites obscure yellow to brown; hypopygium yellow. Male hypopygium (Plate 2, fig. 28) with caudal margin of tergite, 9*t*, emarginate, lobes obtusely rounded. Ventromesal lobe of basistyle, *b*, subglobular, darkened. Dorsal dististyle strongly curved, tip narrowed. Ventral dististyle, *vd*, subglobular, rostral prolongation short and stout; two rostral spines of moderate length, placed close together. One paratype specimen showing three rostral spines on one style only, evidently an abnormality of the specimen. Gonapophysis, *g*, with mesal-apical lobe curved, tip acute.

Habitat.—Northern Korea.

Holotype, male, Seren Mountains, altitude 2,600 feet, October 3, 1937 (*Yankovsky*). Paratopotypes, 5 males.

Limonia (*Dicranomyia*) *infensa* is most generally similar to *L.* (*D.*) *didyma* (Meigen), differing in the details of coloration and structure of the male hypopygium, as the short, slightly separated rostral spines and the less strongly curved dorsal dististyle.

LIMONIA (DICRANOMYIA) SUBAURITA sp. nov. Plate 1, fig. 6; Plate 2, fig. 29.

Belongs to *morio* group, allied to *aurita;* large (wing, male, over 8 millimeters); halteres with base of stem yellow, remainder black; fore femora extensively blackened, bases narrowly yellow; middle and hind femora yellow basally, passing through brown to brownish black; wings with a strong brownish tinge, stigma darker; abdomen black, caudal borders of segments, especially of tergites, pale; basal sternites on subterminal portion extensively yellow; male hypopygium with tergal arms slender, notch between them about as wide as deep; ædeagus dilated beyond midlength.

Male.—Length, about 7.5 to 8 millimeters; wing, 8.5 to 9.

Rostrum and palpi black. Antennæ black; flagellar segments oval, constricted at incisures, with conspicuous verticils; terminal segment elongate. Head with front and broad anterior vertex silvery white; posterior sclerites of head dull black.

Pronotum grayish black. Mesonotum polished black, median region of scutum, central portion of scutellum, and cephalic end of mediotergite with a yellowish gray pollen. Pleura black, sparsely gray-pruinose. Halteres relatively long, basal half or more of stem yellow, remainder black. Legs with fore coxæ blackened basally, apex narrowly yellow; middle and posterior coxæ uniformly yellow; trochanters yellow; fore femora extensively blackened, bases narrowly yellow; middle and hind femora yellow basally, passing into brown, tips more brownish black; tibiæ brown; tarsi black. Wings (Plate 1, fig. 6) with a strong brown tinge, oval stigma darker brown; cord and outer end of cell 1st M_2 very narrowly and vaguely seamed with darker; prearcular field more yellowish; veins dark, yellow in prearcular field. Venation: Sc_1 long, ending opposite or just beyond origin of Rs; m-cu just before fork of M.

Abdomen black, caudal borders of more basal tergites narrowly pale; basal sternites with subterminal portion conspicuously yellow, caudal borders narrowly grayish; hypopygium black. Male hypopygium (Plate 2, fig. 29) with tergal arms, *9t,* stouter than in *aurita,* notch narrower, about as wide as deep. Basistyle, *b,* with ventromesal lobe shorter than in *aurita,* stem stouter, pendant distal portion shorter than either the stem or the thickness at the bend. Dorsal dististyle, *dd,* with apex expanded, bispinous. Spine of ventral dististyle, *vd,* conspicuous but pale, from a low basal tubercle; apex of prolongation narrow. Gonapophysis, *g,* with mesal-apical lobes relatively

short, nearly straight. Ædeagus, *a*, narrower than in either *aurita* or *pseudomorio*, dilated beyond midlength, sides setiferous.

Habitat.—Northern Korea.

Holotype, male, Ompo, May 28, 1937 (*Yankovsky*). Paratopotype, male, June 12, 1937.

The nearest ally is *Limonia* (*Dicranomyia*) *aurita* Alexander, of Formosa, which differs especially in the details of structure of the male hypopygium, as described above. The fly is more or less intermediate between *aurita* and *L.* (*D.*) *pseudomorio* (Alexander), of Japan, yet evidently distinct from either in the genitalic details.

LIMONIA (GERANOMYIA) GIFUENSIS (Alexander).

Geranomyia (*Geranomyia*) *gifuensis* ALEXANDER, Ann. Ent. Soc. America 14 (1921) 114, 115.

Known hitherto from the Japanese Islands. Northern Korea, Ompo, altitude 160 feet, June 3 to 12, 1937; Seren Mountains, altitude 3,000 to 3,500 feet, October 9, 1937 (*Yankovsky*).

LIMONIA (GERANOMYIA) NEAVOCETTA sp. nov.

Allied to *avocetta;* general coloration of mesonotum dark gray, humeral and sublateral portions of præscutum obscure yellow; median area of scutum, scutellum, and a central triangle on mediotergite paler gray; thoracic pleura chiefly pale yellow; femora yellow, tips of posterior femora brownish black, remaining femora less distinctly darkened; wings brownish yellow, heavily patterned with brown; dark spots at ends of veins R_3 and R_{4+5} interconnected by dark marginal seams; abdominal tergites dark brown, sternites yellow.

Female.—Length, excluding rostrum, about 10 millimeters; wing, 9.8; rostrum alone, about 3.

Rostrum black, relatively long, stout at base; palpi black. Antennæ black, first flagellar segment a trifle paler; flagellar segments oval, outer ones a little more elongate. Head dark brownish gray; anterior vertex narrow.

Pronotum dark brownish gray, lined sublaterally with paler. Mesonotal præscutum with disc dark gray, humeral and sublateral portions posteriorly broadly obscure yellow; a capillary black median vitta on anterior portion of sclerite; scutal lobes dark gray, lateral portions restrictedly paler, mesal edge of each lobe narrowly blackened; median area of scutum, scutellum, and a central triangle on mediotergite paler gray, lateral borders

of mediotergite darker. Pleura chiefly obscure yellow, pleurotergite darker. Halteres pale yellow, knobs weakly darkened. Legs with coxæ and trochanters pale yellow; femora yellow, tips of posterior pair conspicuously brownish black, of remaining femora less distinctly darkened; tibiæ and tarsi brownish yellow, outer tarsal segments blackened. Wings brownish yellow, prearcular region and costal border, especially cell Sc, light yellow; a heavy brown pattern, largest areas costal in distribution, first at arculus, third at origin of Rs, fourth at fork Sc, the two latter separated by a distance a little narrower than diameter of either; stigmal area large, produced behind into cell R_3; areas at ends of veins R_2 and R_{4+5} interconnected by a dark marginal seam in cells R_2 and R_3; narrow brown seams along cord and outer end of cell 1st M_2; a small oval spot at end of vein 2d A; vein 1st A unmarked or virtually so; veins yellow, darker in clouded areas. Venation: Sc long, Sc_1 ending nearly opposite midlength of Rs; m-cu shortly before fork of M.

Abdominal tergites dark brown, caudal borders of segments narrowly paler; sternites yellow; subterminal segments more uniformly darkened.

Habitat.—Northern Korea.

Holotype, female, Ompo, altitude 170 feet, June 3, 1937 (*Yankovsky*).

Closest to *Limonia* (*Geranomyia*) *avocetta* (Alexander), of Japan, differing as follows: Mesonotum dark gray, scutum, scutellum, and central area of mediotergite conspicuously pale; femoral tips darkened.

DICRANOPTYCHA PROLONGATA sp. nov. Plate 1, fig. 7; Plate 2, fig. 30.

General coloration brown; antennæ with basal two segments obscure yellow, flagellum dark brown; halteres pale yellow; femora yellow, tips narrowly blackened, the amount subequal on all legs; wings with a brown tinge, cell Sc clearer yellow; no dark cubital seam; Rs subequal in length to cell 1st M_2; Rs almost in longitudinal alignment with R_{4+5}; abdominal tergites dark brown, proximal segments paler medially, subterminal segments black, hypopygium yellow; male hypopygium with outer dististyle relatively narrow, apex long-produced; lateral tergal arms pale, nearly parallel-sided, tips obtuse.

Male.—Length, about 8.5 to 9 millimeters; wing, 9 to 9.5.

Female.—Length, about 8.5 to 9 millimeters; wing, 9.5 to 10.

Rostrum and palpi black. Antennæ with scape and pedicel obscure yellow, flagellum dark brown; flagellar segments elon-

gate-oval, with conspicuous verticils. Head brownish gray, opaque.

Pronotum opaque brown. Mesonotum brown, humeral region of præscutum a little more reddish brown; scutellum slightly more testaceous; postnotum more pruinose. Pleura brown, sparsely pruinose, ventral anepisternum and meron, with ventral sternopleurite, darker, forming incomplete stripes. Halteres pale yellow. Legs with coxæ and trochanters yellow; femora yellow, tips narrowly but conspicuously blackened, the amount subequal on all legs; tibiæ yellow, extreme bases and tips blackened; basitarsi yellow, outer segments infuscated. Wings (Plate 1, fig. 1) with a brown tinge, cell Sc clearer yellow; very vaguely indicated darker seams at origin of Rs, along cord, and at outer end of cell 1st M_2; no dark cubital seam as in *venosa;* veins brown, Sc yellow. Venation: Sc_1 opposite r-m; Rs moderately long, subequal in length to cell 1st M_2; basal section of R_{4+5} long, almost in alignment with Rs; m-cu variable in position, from about one-fourth to midlength of cell 1st M_2.

Abdominal tergites dark brown, proximal segments with basal portions more brightened, in cases segments almost uniformly pale with lateral borders darkened; subterminal segments uniformly black; hypopygium yellow. Male hypopygium (Plate 2, fig. 30) with outer dististyle, *od*, relatively narrow, apex produced into a long, gently curved, black spine; before apex with numerous erect spinulæ and scabrous points, the former on ventral surface. Inner dististyle, *id*, with apex narrowed. Lateral tergal arms, 9*t*, gently curved, nearly parallel-sided, tips a trifle widened, obtuse.

Habitat.—Northern Korea.

Holotype, male, Ompo, altitude 800 feet, September 13, 1937 (*Yankovsky*). Allotopotype, female. Paratopotypes, males and females, altitude 800 to 1,750 feet, September 13 to October 27, 1937 (*Yankovsky*). Paratypes, males and females, Seren Mountains, altitude 2,000 to 3,000 feet, October 10 to 15, 1937 (*Yankovsky*).

The nearest regional ally is *Dicranoptycha venosa* Alexander, which differs especially in the coloration of the body, legs, and wings, and in the distinct structure of the male hypopygium. A few specimens of the type series show abnormalities of venation. One paratype has an adventitious crossvein in cell R_3 of both wings, almost immediately beneath R_2. A second paratype, on one wing only, has a short spur on distal section of

vein R_{4+5} at near four-fifths the length, jutting cephalad into cell R_3.

DICRANOPTYCHA DIACANTHA sp. nov. Plate 1, fig. 8; Plate 2, fig. 31.

General coloration black, sparsely pruinose; halteres pale yellow throughout; legs black, femora very restrictedly paler at bases; wings with a weak brown tinge; Rs considerably longer than cell 1st M_2; branches of Rs lying parallel to one another for virtually their entire length; abdomen (male) almost uniformly light yellow, with a dark-brown or brownish-black subterminal ring; hypopygium brown; outer dististyle small, outer margin smooth; gonapophyses conspicuously bispinous.

Male.—Length, about 10 millimeters; wing, 11 to 11.5.

Female.—Length, about 12 millimeters; wing, 11.5.

Rostrum and palpi brownish black. Antennæ brownish black, pedicel a trifle paler. Head light gray; anterior vertex wide, about twice diameter of scape.

Thorax black, sparsely pruinose, præscutum with three more or less distinct darker and more nitidous stripes that are more or less confluent to cover the disc behind; posterior sclerites of notum more heavily pruinose, especially in female. Pleura black, pruinose. Halteres pale yellow throughout. Legs with coxæ yellow, fore pair slightly darker; remainder of legs black, femoral bases very restrictedly paler, tibiæ a little more brownish black. Wings (Plate 1, fig. 8) with a weak brown tinge, prearcular field and costal border a trifle more yellowish, not conspicuously so as in *stygipes;* veins dark brown. Venation: Rs considerably longer than cell 1st M_2; branches of Rs parallel to one another for virtually their whole length, rather strongly deflected caudad at their outer ends; m-cu shortly before midlength of cell 1st M_2.

Abdomen of male almost uniformly light yellow, subterminal segments dark brown or brownish black; hypopygium brown. In the female, the abdomen is more uniformly darkened. Male hypopygium (Plate 2, fig. 31) with lateral tergal arms, 9*t*, slender, erect, nearly parallel-sided, their tips obtuse. Outer dististyle, *od,* small, much shorter than inner, curved to a long black apical point, outer margin smooth, inner margin before spine with small scabrous points. Ædeagus, *a,* long. Gonapophysis, *g,* produced into two long conspicuous spines.

Habitat.—Northern Korea.

Holotype, male, Seren Mountains, altitude 5,000 to 6,000 feet, October 3, 1937 (*Yankovsky*). Allotopotype, female. Parato-

potype, 1 male; paratype, 1 male, Chonsani, Paiktusan, altitude 3,700 feet, July 22, 1937 (*Yankovsky*).

The closest relative of the present fly is *Dicranoptycha stygipes* Alexander, of Japan, which has somewhat similarly blackened legs, differing especially in the coloration of the body and wings and in the details of venation, as the short Rs. The male sex of *stygipes* is unknown to me.

ANTOCHA (ANTOCHA) BIFIDA Alexander.

Antocha (*Antocha*) *bifida* ALEXANDER, Philip. Journ. Sci. 24 (1924) 564–566.

One male, from Ompo, northern Korea, altitude 900 feet, October 28, 1937, collected by Yankovsky, has cell M_2 open by the atrophy of m. The structure of the male hypopygium does not appear to differ significantly from the type material.

HELIUS (HELIUS) POLIONOTA sp. nov. Plate 1, fig. 9.

General coloration gray, præscutum with three brown stripes; rostrum longer than remainder of head; antennæ with scape and pedicel black, flagellum obscure yellow; halteres pale yellow; femora yellow, tips abruptly and conspicuously black; wings whitish subhyaline, tip broadly but inconspicuously darkened; stigma oval, dark brown; prearcular field and costal border very pale yellow; m-cu less than its own length beyond fork of M.

Female.—Length, including rostrum, 7.5 to 8.5 millimeters; wing, 8.5 to 9; rostrum alone, 1.

Rostrum longer than remainder of head, black; palpi black. Antennæ with scape and pedicel black; flagellum obscure yellow, outer segments a little darker. Head gray, with a very narrow and poorly indicated darker median line on center of vertex; anterior vertex narrow, a little more than diameter of scape; head prolonged behind.

Pronotum gray. Mesonotum gray, præscutum with three brown stripes, median stripe broader and darker, not reaching suture behind; scutellum posteriorly a trifle more reddish brown. Pleura, including dorsopleural membrane, dark brown. Halteres uniformly pale yellow. Legs with coxæ yellow, fore and middle pair somewhat more infuscated basally; trochanters yellow; tips abruptly and conspicuously black, the amount subequal on all legs; tibiæ obscure yellow, tips very narrowly blackened; basitarsi yellow basally, passing into black; remaining tarsal segments black. Wings (Plate 1, fig. 9) whitish

subhyaline, tip broadly but inconspicuously darkened; prearcular field and costal border very pale yellow; stigma oval, dark brown; veins dark brown, paler in yellow areas. Venation: Sc_1 ending about opposite fork of Rs, Sc_2 at its tip; cell 1st M_2 long, a little wider at basal end, subequal in length to vein M_4 beyond it; m-cu less than its own length beyond fork of M.

Abdomen dark brown, very sparsely gray pruinose; valves of ovipositor elongate, horn-colored.

Habitat.—Northern Korea.

Holotype, female, Chonsani, Paiktusan, altitude 3,000 feet, July 18, 1937 (*Yankovsky*). Paratopotypes, 5 females, altitude 3,000 to 3,500 feet, July 18 to 20, 1937 (*Yankovsky*).

Helius (*Helius*) *polionota* is entirely distinct from the other regional species of the genus, the gray coloration of the thorax, the pale antennal flagellum and the distinctive pattern of the legs and wings.

HELIUS (HELIUS) GRACILLIMUS sp. nov. Plate 1, fig. 10; Plate 2, fig. 32.

General coloration of mesonotum obscure yellow, præscutum with faint indications of darker stripes; posterior sclerites of notum darkened, pleura and pleurotergite yellow; rostrum dark, a little longer than remainder of head; halteres yellow, knobs infuscated; legs obscure yellow, tips of femora and tibiæ narrowly dark brown; wings grayish subhyaline, prearcular and costal portions a little more yellowish; a restricted brown pattern, including seams at origin of Rs and along cord; m-cu shortly beyond fork of M; abdominal tergites dark brown, lateral margins yellow; basal sternites more uniformly yellow; male hypopygium with basistyles slender, on mesal face near base with a stout setiferous lobe; outer dististyle an unusually slender blackened rod, apex simple and obtuse.

Male.—Length, including rostrum, about 7 millimeters; wing, 8; antennæ, about 3.

Female.—length, including rostrum, about 9.5 to 11 millimeters; wing, 9 to 10.

Rostrum slightly longer than remainder of head, dark brownish gray; palpi black. Antennæ black, pedicel a trifle brightened; flagellum elongate, especially in male, as shown by measurements; flagellar segments long-cylindrical, with a dense erect pale pubescence and scanty, slightly longer verticils; terminal segment short, approximately one-third to one-fourth penultimate. Head dark gray; anterior vertex narrow.

Pronotum obscure yellow. Mesonotal præscutum obscure yellow, with faint indications of darker stripes, especially behind; scutal lobes conspicuously blackened; posterior sclerites of notum blackened, posterior margin of scutellum narrowly more reddish. Pleura and pleurotergite yellow. Halteres yellow, knobs infuscated. Legs with coxæ and trochanters yellow; femora obscure yellow, tips rather narrowly dark brown; tibiæ obscure yellow, tips narrowly dark brown; tarsi passing into dark brown. Wings (Plate 1, fig. 10) grayish subhyaline in male, somewhat more cream-yellow in female, prearcular and costal regions more yellowish; a restricted brown pattern, including stigma and a confluent seam on cord, together with a smaller cloud at origin of Rs; veins dark brown, pale yellow in luteous areas. Venation: Rs weakly angulated and, in cases, short-spurred at origin; branches of Rs weakly divergent outwardly; cell 1st M_2 rectangular; m-cu shortly beyond fork of M.

Abdominal tergites dark brown, paler yellow laterally, especially conspicuous on outer segments; basal sternites more yellow; ninth segment darkened, styli obscure yellow. Male hypopygium (Plate 2, fig. 32) with basistyle, *b*, unusually long and slender, on mesal face near base with a stout setiferous lobe. Outer dististyle, *od*, an unusually slender blackened rod, very gently curved to simple obtuse tip. Inner dististyle, *id*, longer, tip narrow, gently curved; outer or dorsal portion of style without setæ. Interbases appearing as flattened paddlelike blades, outer margins thickened and darkened.

Habitat.—Northern Korea.

Holotype, male, Seren Mountains, altitude 3,000 to 3,500 feet, October 9, 1937 (*Yankovsky*). Allotopotype, female, altitude 1,800 feet, October 13, 1937. Paratopotypes, 3 males, several females, altitude 1,800 to 3,500 feet, October 3 to 16, 1937; paratypes, 5 females, altitude 1,600 feet, October 27, 1937 (*Yankovsky*).

Helius (*Helius*) *gracillimus* somewhat resembles *H.* (*H.*) *obliteratus* Alexander and *H.* (*H.*) *subfasciatus* Alexander in the general appearance and elongate antennæ in the male sex, but is entirely distinct in the structure of the male hypopygium.

PEDICINI

PEDICIA (PEDICIA) LÆTABILIS sp. nov. Plate 1, fig. 11; Plate 2, fig. 33.

General coloration gray, præscutum with more darker gray stripes that are narrowly bordered by blackish; scutellum yellow; halteres pale yellow; femora brownish yellow, tips not or

scarcely darkened; wings grayish, patterned with brown, markings paler in male than in female; abdomen orange, basal five tergites with three grayish black stripes, outer segments uniformly darkened; basal sternites uniformly light yellow; male hypopygium with outer angle of dististyle terminating in a long black spine from a conspicuous basal tubercle; caudal border of style with a single strong black spine.

Male.—Length, 25 to 27 millimeters; wing, 22 to 25.

Female.—Length, 33 to 35 millimeters; wing, 26 to 27.

Rostrum dark gray; palpi black. Antennæ black, pedicel more reddish; basal segments short and crowded, outer two or three slender and elongate. Head dark gray; vertical tubercle conspicuous, apex truncated and circular in outline, appearing like a scar with slightly raised margins.

Pronotum brownish black, pruinose, posterior border more yellowish. Mesonotal præscutum with humeral region dark brown, disc almost covered by four gray stripes that are narrowly bordered by blackish; posterior sclerites of notum black, sparsely pruinose; scutellum yellow, weakly darkened medially. Pleura dark gray; dorsopleural membrane buffy. Halteres pale yellow. Legs with coxæ gray; trochanters yellow; femora brownish yellow, bases brighter, tips not or scarcely darkened; tibiæ light brown, tips darker brown; tarsi passing into brownish black. Wings (Plate 1, fig. 11) grayish, central portion of disc, including cell R_4 to apex, more yellowish subhyaline; a pale-brown pattern in male, much darker brown in female; cells C and Sc yellow; dark pattern extensive, including major areas in bases of cells R and M and at origin of Rs, these nearly confluent with one another, the latter not quite reaching vein M behind; seam at cord broad, that along vein Cu narrow, in cases more or less obsolete along distal section of Cu_1 but attaining margin; veins brown, more yellow in costal field. Venation: Cord oblique; r-m at or beyond fork of Rs; cell 1st M_2 long.

Abdomen with ground color orange, basal five tergites with three grayish black stripes, lateral pair very narrow, all stripes narrowly interrupted by reddish borders to tergites; sternites uniformly light yellow; outer segments dark brown, more or less pruinose. In female the pattern heavy, median dark tergal stripe distinct, bordered sublaterally by fulvous areas, lateral borders of segments broadly light gray, widened behind; sternites dark brownish gray, narrowly bordered posteriorly by pale. Male hypopygium (Plate 2, fig. 33) with dististyle, *d*,

having outer angle terminating in a long black spine from a conspicuous basal tubercle; inner angle produced, apex truncated; caudal border of style between these angles with a single strong black spine, more or less cultriform in outline; mesal margin of style with a series of black spines, toward base slenderer and passing into setæ.

Habitat.—Northern Korea.

Holotype, male, Ompo, altitude 160 feet, May 20, 1937 (*Yankovsky*). Allotype, female, Seishin, altitude 70 feet, May 13, 1937. Paratopotypes, males, May 20 to 21, 1937; paratypes, 5 males, 1 female, with the allotype, May 13 to 18, 1937 (*Yankovsky*).

Pedicia (*Pedicia*) *lætabilis* is readily told from other large regional species by the pale wing pattern of the male, the brightened color of the abdomen, and the structure of the male hypopygium.

PEDICIA (PEDICIA) SIMULATA sp. nov. Plate 1, fig. 12; Plate 2, fig. 34.

General coloration gray, præscutum with four more brownish gray stripes; antennæ uniformly blackened, flagellar segments short and crowded; halteres pale yellow; femora yellow, tips broadly blackened; tibiæ brownish black, tarsi black; wings brownish yellow, patterned with darker brown, the two colors not conspicuously contrasting; abdominal tergites gray, with two dusky longitudinal lines, interrupted by broad pale posterior borders of segments; male hypopygium with outer angle produced into a strong spine, apex blackened and acute.

Male.—Length, about 16 to 19 millimeters; wing, 15 to 17.

Rostrum grayish pruinose; palpi black. Antennæ black, basal segments pruinose; flagellum very short, normal number of antennal segments apparently 14 but the number apparently variable, basal segments short, crowded. Head gray, with indications of a dusky capillary median vitta; vertical tubercle low.

Pronotum gray, variegated with brown. Mesonotal præscutum light gray, with four more brownish gray stripes, interspaces with conspicuous yellow setæ; posterior sclerites of notum gray, scutal lobes scarcely darkened. Pleura gray; dorsopleural membrane brownish ochreous. Halteres pale yellow. Legs with coxæ gray; trochanters brownish gray; femora yellow, tips broadly blackened, the amount subequal on all legs and including distal fourth or fifth; in some specimens fore femora more extensively blackened, involving distal third or more; tibiæ brownish black; tarsi black. Wings (Plate 1, fig. 12) with

ground color brownish yellow, patterned with darker brown, colors not conspicuously contrasting as is usual in the subgenus; costal and cubital darkenings and a transverse band on cord present; basal third of cells C and Sc more yellowish; basal third of cells R and M extensively darkened, more or less confluent with a broad seam at origin of Rs; a darkened cloud at outer end of cell 1st M_2; veins brown, Sc yellow. Venation: Cord subtransverse to weakly oblique; Rs angulated to spurred at origin; m-cu close to or beyond fork of M. In one paratype cell M_2 of both wings open by atrophy of m.

Abdominal tergites gray, with two dusky longitudinal sublateral lines, broken by broad ochreous posterior borders of segments, lateral borders more narrowly pale; sternites yellowish gray; hypopygium dark gray. Male hypopygium (Plate 2, fig. 34) with basistyle, *b*, unarmed with spines but with numerous elongate setæ. Dististyle, *d*, with outer angle produced into a strong spine, apex acutely pointed and blackened; inner lobes much as in *baikalica*. In the latter species the apical margin of the basistyle bears a group of several stout black spines; outer margin of dististyle scoop-shaped, obtuse at apex, not blackened or produced into a spine.

Habitat.—Northern Korea.

Holotype, male, Chonsani, Paiktusan, altitude 4,650 feet, July 17, 1937 (*Yankovsky*). Paratopotypes, 4 males, altitude 3,800 to 4,650 feet, July 17 to 19, 1937 (*Yankovsky*).

In the nature of the wing pattern, *Pedicia* (*Pedicia*) *simulata* is surprisingly like the Siberian *P.* (*P.*) *baikalica* (Alexander), but differs conspicuously in the details of structure of the male hypopygium, especially the dististyle, which is acutely spined, as is commonly the case in the subgenus *Pedicia*. The series of small-sized members of the subgenus *Pedicia* in eastern Asia, including *baikalica*, *cubitalis* Alexander, *gaudens* Alexander, *grandior* Alexander, and *subtransversa* Alexander, show a perfect transition in characters between those formerly accepted as distinguishing *Pedicia* from *Tricyphona*. These characters in *Pedicia* include major physical size, the nature of the wing pattern, obliquity of the cord, and presence of a primary spine on the outer angle of the dististyle of the male hypopygium. All of these characters break down in the series of small-sized species listed above, and it is very evident that it will be almost impossible to differentiate *Tricyphona* from *Pedicia* except as a matter of convenience in handling the complex of included forms.

PEDICIA (PEDICIA) SUBTRANSVERSA Alexander.

Pedicia subtransversa ALEXANDER, Philip. Journ. Sci. 50 (1933) 146, 147.

Described from the Japanese Alps, Honshiu, Japan.

NORTHERN KOREA, Chonsani, Paiktusan, altitude 5,100 feet, July 21, 1937 (*Yankovsky*). SEREN MOUNTAINS, altitude 2,000 to 3,000 feet, October 2 and 3, 1937 (*Yankovsky*). I can detect no significant differences between the type material and the present series of specimens.

PEDICIA (TRICYPHONA) PATENS sp. nov. Plate 1, fig. 13; Plate 3, fig. 35.

Large (wing, 15 millimeters or more); general coloration yellow, præscutum with more reddish stripes; antennæ with basal segments yellow, remainder brownish black; halteres yellow; femora obscure yellow, tips weakly darkened; tibiæ brown, tips darker; wings tinged with brownish yellow, costal border brown; stigma yellow, ends delimited by slightly darker clouds; r-m at or before fork of Rs; cell M_2 open by atrophy of m; m-cu close to fork of M; abdomen brown, hypopygium blackened; male hypopygium with dististyle bilobed, lobes stout; interbase a strongly curved spine.

Male.—Length, about 14 to 16 millimeters; wing, 15 to 18.

Female.—Length, about 19 to 20 millimeters; wing, 17 to 18.

Rostrum brownish gray; palpi black. Antennæ 16-segmented; scape and pedicel yellow, flagellum brownish black, basal two or three segments paler; flagellar segments passing through oval to long-oval; longest verticils unilaterally distributed, much longer than segments; terminal segment shorter than penultimate. Head gray; vertical tubercle subcircular in outline, darkened.

Pronotum yellow. Mesonotal præscutum testaceous-yellow, chiefly covered by three reddish stripes, posterior interspaces slightly pruinose; scutal lobes reddish; scutellum and postnotum testaceous. Pleura yellow. Halteres relatively long and slender, yellow. Legs with coxæ and trochanters yellow; femora obscure yellow, tips weakly darkened; tibiæ brown, tips darker brown; tarsi black. Wings (Plate 1, fig. 13) with a strong brownish yellow tinge, cells C and Sc darker brown; stigma yellow, both ends delimited by slightly darker color; remainder of disc virtually unmarked or with cord insensibly seamed with darker; veins brown. Venation: Rs variable in length, angulated and spurred at origin; r-m at or before fork of Rs,

latter in longitudinal alignment with R_{4+5}; cell M_2 open by atrophy of m; m-cu at or close to fork of M.

Abdomen brown, outer sternites and hypopygium blackened. Male hypopygium (Plate 3, fig. 35) with dorsal plate of tergite, 9*t*, truncated across caudal margin, with a small U-shaped median notch; ventrad of dorsal plate a fleshy ventral plate, each side bilobed. Basistyle, *b*, without conspicuous lobes; interbase a strong curved spine, tip acute. Dististyle, *d*, bilobed, outer lobe a little longer and more heavily sclerotized than inner, both lobes stout, obtusely rounded at tips.

Habitat.—Northern Korea.

Holotype, male, Ompo, altitude 190 feet, June 2, 1937 (*Yankovsky*).

Allotopotype, female. Paratopotypes, several males, June 1 and 2, 1937.

Pedicia (*Tricyphona*) *patens* is most closely allied to the Japanese *P.* (*T.*) *confluens* (Alexander) and *P.* (*T.*) *kirishimensis* (Alexander), both of which are smaller, with distinctive wing patterns, and with the male hypopygia quite distinct. All three species normally have cell M_2 open by atrophy of m.

PEDICIA (TRICYPHONA) LONGILOBA sp. nov. Plate 1, fig. 14; Plate 3, fig. 36.

General coloration gray, præscutum with four more blackish gray stripes; antennæ 16-segmented, black throughout; halteres pale yellow; femora yellow, tips brownish black; wings yellowish subhyaline, with a restricted darker cloud on anterior cord; stigma lacking; r-m close to midlength of basal section of R_{4+5}; cell M_1 sessile; male hypopygium with interbase bearing a strong lateral spine; basistyle at apex produced into two lobes, outer one unusually long, subequal in length to style itself, expanded and darkened at apex, clothed with abundant long setæ; shorter lobe of basistyle densely set with short black spines; dististyle subequal in length to inner lobe of basistyle, slender, parallel-sided.

Male.—Length, about 9 to 10 millimeters; wing, 9.5 to 10.5.

Rostrum gray; palpi black. Antennæ short, 16-segmented, black throughout; flagellar segments oval; verticils about equal in length to segments. Head gray; vertical tubercle relatively conspicuous.

Thorax gray, præscutum with four more blackish gray stripes, intermediate pair not attaining suture behind; scutal lobes with darkened centers. Pleura gray; dorsopleural membrane buffy.

Halteres pale yellow. Legs with coxæ yellow, slightly darkened basally; trochanters yellow; femora yellow, tips brownish black, the amount subequal on all legs; tibiæ and basitarsi brownish yellow, tips narrowly darkened; terminal tarsal segments dark brown. Wings (Plate 1, fig. 14) yellowish subhyaline, prearcular field restrictedly bright yellow; a small darkened cloud on anterior cord; stigma lacking; veins brown. Venation: Rs relatively long, angulated, and spurred at origin; r-m close to midlength of basal section of R_{4+5}; cell M_1 sessile; m beyond fork of M_{1+2}.

Abdominal tergites brown, caudal borders narrowly pale; sternites more uniformly grayish yellow or brownish yellow; ninth segment blackened, basistyles yellow. Male hypopygium (Plate 3, fig. 36) with tergal lobes, *9t*, appearing as glabrous flattened ears, widely separated; surface of tergite with abundant long delicate setulæ. Basistyle, *b*, with interbase, *i*, unusually long, narrowed to a curved apical hook, at near midlength bearing a long conspicuous spine, with long delicate setæ on hook beyond spine; basistyle at apex prolonged into two lobes, outer lobe very long, subequal in length to basistyle itself, expanded and darkened at tips, with abundant long setæ; shorter lobe oval in outline, densely set with short black peglike spines. Dististyle, *d*, subequal in length to shorter lobe of basistyle, narrow, parallel-sided, apex rounded with four or five elongate setæ; base of style with additional setæ.

Habitat.—Northern Korea.

Holotype, male, Ompo, May 28, 1937 (*Yankovsky*). Paratopotypes, 5 males, May 28 to June 15, 1937 (*Yankovsky*).

The present fly rather closely resembles *Pedicia* (*Tricyphona*) *optabilis* (Alexander) and *P.* (*T.*) *ussurica* Alexander, but has the male hypopygium entirely different in construction, the unusually long, clavate outer lobe of the basistyle being quite unique among the species of *Tricyphona* known to me.

PEDICIA (TRICYPHONA) DIAPHANOIDES sp. nov. **Plate 1, fig. 15.**

Belongs to *diaphana* group; general coloration yellowish gray, præscutum with three dark-brown stripes, median stripe narrowly split behind; antennæ black, 14-segmented; femora dark brown, bases yellow; wings with a brown tinge, oval stigma darker brown; Rs angulated at origin; r-m connecting with vein R_5 about its own length beyond origin.

Female.—Length, about 10 to 11 millimeters; wing, 10 to 10.5.

Rostrum gray; palpi black. Antennæ 14-segmented, black throughout; flagellar segments oval. Head dark brown, anterior vertex and orbits gray.

Pronotum brownish gray. Mesonotal præscutum yellowish gray, with three dark-brown stripes, median stripe broad, slightly divided behind; centers of scutal lobes darkened. Pleura gray; dorsopleural membrane grayish yellow. Halteres with stem yellow, knob brown. Legs with coxæ gray, tips yellow; trochanters yellow; femora dark brown, bases yellow; tibiæ and tarsi brownish black. Wings (Plate 1, fig. 15) with a brown tinge; stigma oval, darker brown, conspicuous against the ground; veins brown. Venation: Rs variable in length, from subequal in length to distance between Sc_2 and its origin to about two-thirds this distance, strongly angulated at origin; cell M_1 present; cell M_2 normally open by atrophy of m, in cases closed; m-cu some distance beyond fork of M.

Abdomen brown, outer segments darker.

Habitat.—Northern Korea.

Holotype, female, Ompo, May 28, 1937 (*Yankovsky*). Paratopotypes, 2 females.

Pedicia (*Tricyphona*) *diaphanoides* is most closely allied to *P.* (*T.*) *diaphana* (Doane) of western North America. It differs in the number and structure of the flagellar segments and in the less extensively divided median præscutal stripe. No representatives of the group have been found hitherto in the eastern Palæarctic Region.

HETERANGAEUS GLORIOSUS (Alexander) var.

Polyangaeus gloriosus ALEXANDER, Philip. Journ. Sci. 24 (1924) 569–571.

The types are from Saghalien. One female, Chonsani, Paiktusan, northern Korea, altitude 3,700 feet, July 14, 1937 (*Yankovsky*).

DICRANOTA (RHAPHIDOLABIS) FLAVIBASIS MINUSCULA subsp. nov.

Male.—Length, about 6.5 millimeters; wing, 7.

Generally similar to the typical form (Japan) but smaller and differing in the following respects: Legs pale brown, outer tarsal segments darker. Wings with stigma poorly indicated, pale brown; no distinct darkened clouds along cord or vein Cu; wing base less conspicuously yellow. Venation: Rs longer, gently arcuated; R_{2+3+4} long, subequal to or exceeding R_2; Sc relatively short, ending before proximal end of stigma or about opposite

one-third length of R_{2+3}; m-cu nearly its own length beyond fork of M. Male hypopygium much as in typical *flavibasis*, differing as follows: Ninth tergite more deeply emarginate, lateral lobes thus more conspicuously, broadly rounded. Outer dististyle narrower; inner style shorter. Lateral tergal arms only gently curved to acute tips, not angularly bent at midlength.

Habitat.—Northern Korea.

Holotype, male, Ompo, altitude 800 feet, September 22, 1937 (*Yankovsky*).

DICRANOTA (RHAPHIDOLABIS) LUTEOLA sp. nov. Plate 1, fig. 16.

General coloration of thorax and abdomen yellow, gibbous præscutum pale brown; antennæ 13-segmented, scape and pedicel yellow, flagellum black; halteres yellow; femora brown, tibiæ and basitarsi whitish, tips narrowly darkened; wings whitish subhyaline, veins beyond cord a little darker; cell R_2 short- to long-petiolate.

Female.—Length, about 5.5 to 6 millimeters; wing, 6.5 to 7.

Rostrum yellow; basal segments of palpi yellow, terminal two segments black. Antennæ 13-segmented; scape and pedicel yellow, flagellum black; flagellar segments oval, with verticils of moderate length. Head brownish gray.

Mesonotal præscutum pale brown, gibbous; posterior sclerites of notum, together with the pleura, yellow. Halteres pale yellow. Legs with coxæ and trochanters yellow; femora brown; tibiæ and tarsi whitish, tips narrowly darkened; terminal tarsal segments more darkened. Wings (Plate 1, fig. 16) whitish subhyaline, cells beyond cord a trifle darker, best evidenced by darker veins. Venation: Cell R_3 short- to long-petiolate, R_{2+3+4} variable in length, from longer to shorter than basal section of R_5; cell M_1 present; cell M_2 closed; m-cu beyond one-third the length of M_{3+4}.

Abdomen yellow, tergites a little more infumed, especially medially; valves of ovipositor long and powerful.

Habitat.—Northern Korea.

Holotype, female, Ompo, altitude 150 feet, June 7, 1937 (*Yankovsky*). Paratopotype, female.

Dicranota (*Rhaphidolabis*) *luteola* is readily told by the general yellow color of the thorax and abdomen. It is apparently closest to the Japanese *D.* (*R.*) *consors* (Alexander) and *D.* (*R.*) *subconsors* (Alexander) which differ in the dark coloration and details of venation.

DICRANOTA (RHAPHIDOLABIS) NEOCONSORS sp. nov. Plate 1, fig. 17; Plate 3, fig. 37.

Allied to *consors*; general coloration of mesonotum grayish testaceous, præscutum with three conspicuous dark-brown to brownish black stripes; antennæ 12-segmented, halteres pale, knobs weakly darkened; legs pale brown; wings grayish subhyaline, stigma very slightly darker; R_2 transverse; R_{2+3+4} relatively short; male hypopygium with lateral tergal arms appearing as elongate-oval blades; basistyle with a group of strong setæ on mesal face near base; interbase a strongly flattened blade, ventral margin serrulate, apex produced into a strong spine.

Male.—Length, about 4.5 millimeters; wing, 5.2.

Female.—Length, about 5.5 millimeters; wing, 6.5.

Rostrum testaceous-yellow; basal segments of palpi pale, terminal segments dark brown. Antennæ 12-segmented; scape pale, remaining segments dark brown; terminal segment longer than penultimate. Head dark brown.

Mesonotum grayish testaceous, the highly convex præscutum with three conspicuous dark-brown stripes, median stripe even more blackened; lateral borders of præscutum paling to yellow; scutal lobes more diffusely darkened; scutellum and mediotergite weakly darkened. Pleura obscure yellow, ventral sternopleurite and ventral pleurotergite more darkened. Halteres pale, knobs weakly darkened. Legs with coxæ brownish yellow; trochanters yellow; remainder of legs pale brown, outer tarsal segments darker. Wings (Plate 1, fig. 17) grayish subhyaline, stigma very slightly darker; veins brown. Venation: R_2 transverse; R_{2+3+4} relatively short, subequal to r-m.

Abdomen dark brown. Male hypopygium (Plate 3, fig. 37) with median lobe of tergite, 9*t*, broad, margin truncate, with numerous strong setæ; lateral tergal arms appearing as flattened, elongate-oval blades, on edge appearing linear. Basistyle, *b*, with a group of strong setæ on mesal face near base, as in *consors;* apex of basistyle without spinous points excepting a very few at inner apical angle. Interbase, *i*, a strongly flattened blade that terminates in a long straight acute spine, lateral or ventral edge with a series of microscopic serrulations.

Habitat.—Northern Korea.

Holotype, male, Seren Mountains, altitude 6,200 feet, October 10, 1937 (*Yankovsky*). Allotype, female, Ompo, altitude 650 feet, August 11, 1937 (*Yankovsky*).

The nearest ally of the present fly is *Dicranota* (*Rhaphidolabis*) *consors* Alexander, of Japan, which differs in the details of coloration and, especially, in the structure of the male hypopygium, notably the interbases.

HEXATOMINI

LIMNOPHILA (PHYLIDOREA) MEGAPYGIA sp. nov. Plate 1, fig. 18; Plate 3, fig. 38.

General coloration of mesothorax yellow, unmarked; antennæ (male) elongate, if bent backward extending about to third abdominal segment; basal three segments obscure yellow, remaining segments black, incisures of the more basal segments pale; femora yellow, tips narrowly blackened, the amount subequal on all legs; wings brownish yellow, prearcular and costal fields clearer yellow; a restricted brown pattern; Rs relatively long, square and spurred at origin; abdomen yellow with a black subterminal ring; male hypopygium large, caudal margin of tergite with a small notch; outer dististyle slender, at apex bent at a right angle, its outer margin roughened; gonapophyses bearing a very slender lateral branch at near midlength.

Male.—Length, about 8.5 to 9.5 millimeters; wing, 7.5 to 8.5; antennæ, about 3.7 to 3.8.

Female.—Length, about 11 millimeters; wing, 10.

Rostrum testaceous-yellow; palpi black. Antennæ (male) elongate, if bent backward extending about to third abdominal segment; basal three segments obscure yellow, succeeding segments black, incisures of more basal segments paler, outer segments uniformly darkened; flagellar segments fusiform, with a dense erect white pubescence; verticils just before midlength of segments. Head brownish gray, posterior portions obscure yellow.

Pronotum brown. Mesothorax uniformly yellow, surface more or less nitidous. Halteres pale, knobs weakly darkened. Legs with coxæ and trochanters yellow; femora yellow, tips rather narrowly but conspicuously blackened, the amount subequal on all legs; tibiæ yellow, tips more narrowly blackened; tarsi black, proximal portions of basitarsi extensively yellow. Wings (Plate 1, fig. 18) with a strong brownish yellow tinge, prearcular and costal fields clearer yellow; stigma oval, varying from pale to dark brown; restricted brown seams at origin of Rs, along cord and at outer end of cell 1st M_2; wing tip in outer radial field more weakly darkened; a central dusky streak in cell R; veins brown, luteous in yellow areas. Venation: Rs relatively long, square, and spurred at origin; R_{2+3+4} in direct longitudinal

alignment with Rs; cell R_3 narrowed at proximal end; m-cu at midlength of cell 1st M_2; vein 2d A sinuous.

Abdomen polished yellow to rusty yellow, incisures, especially laterally on the more basal segments, blackened, the color more or less interrupted at the midline; subterminal segments and base of hypopygium black, styli of large hypopygium rusty. Male hypopygium (Plate 3, fig. 38) with caudal margin of tergite, *9t*, with a small, very shallow median notch, margin not produced. Outer dististyle, *od*, slender, narrowed outwardly, at apex bent at a right angle, its outer margin roughened. Inner dististyle about two-thirds as long, narrowed to obtuse tip. Interbase, *i*, appearing as a fleshy lobe, apex truncate, mesal edge produced into a small cultriform blade. Gonapophyses, *g*, appearing as long slender curved spines, at near midlength bearing a very slender lateral branch that is about one-half as long as apophysis beyond its insertion.

Habitat.—Northern Korea.

Holotype, male, Chonsani, Paiktusan, altitude 3,800 feet, July 23, 1937 (*Yankovsky*). Paratopotypes, 10 males, altitude 3,500 to 3,800 feet, July 15 to 23, 1937 (*Yankovsky*).

Among the European species the present fly is most generally similar to *Limnophila* (*Phylidorea*) *glabricula* (Meigen), differing conspicuously in the structure of the hypopygium. It is likewise allied to *L.* (*P.*) *poetica* Osten Sacken and *L.* (*P.*) *subpoetica* Alexander, yet is amply distinct. I am following Edwards in placing these species that are allied to *bicolor* (Meigen) in the subgenus *Phylidorea.*

LIMNOPHILA (PHYLIDOREA) SUBPOETICA MULTIDENTATA subsp. nov.

Male.—Length, about 7 to 7.5 millimeters; wing, 7.5 to 8; antennæ, about 3.1 to 3.3.

Female.—Length, about 8.5 millimeters; wing, 7.5.

Differs from typical *subpoetica* Alexander, of Saghalien, as follows: Smaller. Antennal flagellum weakly bicolored, dark brown, incisures yellow, on outer segments the color more uniformly dark brown. Legs with femora yellow, tips rather narrowly blackened, the amount subequal on all legs, including about distal fourth or fifth; tibiæ yellow, tips narrowly dark brown. Wings with dark seams at origin of Rs and along cord more conspicuous; wing tip narrowly but more distinctly darkened and with small darkened marginal clouds at ends of longitudinal veins. Rs square and short-spurred at origin. Abdomen brownish yellow, outer segments uniformly blackened

except obscure yellow to brown basistyles. Male hypopygium with apical lobes of tergite much stouter than in typical form, their apices broadly obtuse. Outer dististyle with apical point elongate, about equal to one-third length of stem. Gonapophysis with lateral appendage consisting of several short blunt points instead of two simple spurs as in *subpoetica*.

Habitat.—Northern Korea.

Holotype, male, Chonsani, Paiktusan, altitude 3,800 feet, July 23, 1937 (*Yankovsky*). Allotopotype, female. Paratopotypes, males and females.

I believe that this fly will be found to represent a valid species when more material of the typical form becomes available.

LIMNOPHILA (PHYLIDOREA) PERNIGRITA sp. nov. Plate 1, fig. 19; Plate 3, fig. 39.

General coloration gray-pruinose, præscutum and scutum with polished black areas; antennæ (male) black, relatively elongate; halteres yellow; femora yellow, tips black; wings cream-yellow, prearcular and costal regions more saturated yellow; a relatively heavy brown wing pattern; R_{2+3+4} short, subequal to basal section of R_5; cell M_1 present; abdomen black throughout; male hypopygium with basistyle produced caudad into a long conical lobe; outer dististyle bispinous at apex, at base on outer face with a setuliferous flange.

Male.—Length, about 9 to 10 millimeters; wing, 9 to 10; antennæ, about 3 to 3.2.

Rostrum and palpi black. Antennæ (male) black throughout, relatively elongate, as shown by measurements, if bent backward extending about to base of abdomen; basal flagellar segments short-oval to subglobular, ventral faces protuberant; longest verticils a little longer than segments; outer flagellar segments passing into oval, terminal segment slender. Head dull brownish gray, front and orbits clearer gray.

Pronotum brownish gray. Mesonotal præscutum with ground color heavily brownish gray-pruinose, conspicuously patterned with three polished black stripes; median stripe broad, not reaching suture behind, posterior third deeply incised; lateral stripes crossing suture onto scutal lobes; pseudosutural foveæ and lateral borders of præscutum black; posterior sclerites of notum heavily brownish gray-pruinose. Pleura heavily gray-pruinose. Halteres uniformly yellow. Legs with coxæ black, pruinose; trochanters obscure yellow; femora yellow, tips broadly and conspicuously blackened, most extensive on fore femora where nearly distal third to half is included, narrower on posterior

femora; tibiæ light brown to yellowish brown, tips narrowly blackened; tarsi black. Wings (Plate 1, fig. 19) with ground color cream-yellow, prearcular region and cells C and Sc more saturated yellow; stigma dark brown; a relatively heavy pale brown pattern, as follows: At near one-third the length of cell R adjoining vein R; origin of Rs; cord and outer end of cell 1st M_2; forks of R_{2+3+4} and M_{1+2}; paler brown washes in outer ends of cells M, Cu, and anals; wing tip in outer radial field a little darkened; costal field unmarked except for a tiny spot on Sc_2; veins yellow in ground areas, infuscated in darkened portions. Venation: Rs relatively long, strongly arcuated at origin; R_{2+3+4} short, subequal to basal section of R_5; cell M_1 subequal to its petiole; m-cu at near midlength of cell 1st M_2; anterior arculus preserved.

Abdomen black throughout. Male hypopygium (Plate 3, fig. 39) with basistyle, *b*, produced into a long conical lobe. Outer dististyle, *od*, with a large basal flange on outer margin, surface with abundant microscopic setulæ; apex of style bispinous. Inner dististyle with apex prolonged into a slender cylindrical point. Ædeagus relatively short, slender, subtended on either side by flattened apophyses, *g*, the truncated apices of which bear three or four spinous points.

Habitat.—Northern Korea.

Holotype, male, Chonsani, Paiktusan, altitude 3,500 feet, July 18, 1937 (*Yankovsky*). Paratopotypes, 5 males.

Limnophila (*Phylidorea*) *pernigrita* is quite distinct from other palæarctic members of the *bicolor* group, as *L.* (*P.*) *abdominalis* (Meigen), *L.* (*P.*) *bicolor* (Meigen), *L.* (*P.*) *conifera* Lackschewitz, *L.* (*P.*) *nigricollis* (Meigen), *L.* (*P.*) *prolixicornis* Lundström, and others. *L. conifera* has the basistyles of the hypopygium conically produced, somewhat as in the present fly, but in all other respects is entirely distinct.

LIMNOPHILA (PRIONOLABIS) ACANTHOPHORA sp. nov. Plate, 1, fig. 20; Plate 3, fig. 40.

General coloration polished black, head and pronotum opaque; antennæ 16-segmented; halteres yellow; legs black, femoral bases narrowly yellow; wings brownish yellow, sparsely patterned with brown; cell M_1 present; male hypopygium with caudal margin of tergite emarginate; inner dististyle simple; gonapophyses pale yellow, stem slender, head expanded, its inner angle produced into a spine, the outer end a deep cultriform blade.

Male.—Length, about 10 millimeters; wing, 11.

Rostrum and palpi black. Antennæ 16-segmented, black throughout; basal flagellar segments subglobular, outer segments more elongate; terminal segment one-half longer than penultimate. Head black, with a yellow pollinosity.

Pronotum dull brownish black. Mesonotum polished black, vestiture sparse but erect. Pleura black, sparsely pruinose, especially on ventral pleurites. Halteres pale yellow. Legs with coxæ black; trochanters brownish black; femora black, bases narrowly (basal fifth or sixth) yellow; tibiæ and basitarsi brownish black, tips darker; remainder of tarsi black. Wings (Plate 1, fig. 20) brownish yellow, prearcular and costal regions clear light yellow; stigma oval, dark brown; restricted brown seams along cord, outer end of cell 1st M_2, along vein Cu, and as a spot at origin of Rs; veins brown, yellow in flavous areas. Venation: Cell M_1 present; m-cu beyond midlength of cell 1st M_2.

Abdomen, including hypopygium, black. Male hypopygium (Plate 3, fig. 40) with caudal margin of tergite, 9*t*, with a deep U-shaped median notch. Outer dististyle, *od*, with outer setiferous lobe long and conspicuous; inner lobe terminating in an outer slender spine, inner lobe flattened, vaguely toothed. Inner dististyle, *id*, simple, terminating in four or five strong spines. Ædeagus, *a*, moderately narrow, tip long-produced. Gonapophysis, *g*, distinctive, pale yellow; stem very slender, head expanded, its inner angle produced into a slender spine, opposite end deep, more or less cultriform.

Habitat.—Northern Korea.

Holotype, male, Ompo, altitude 150 feet, May 29, 1937 (*Yankovsky*).

Limnophila (*Prionolabis*) *acanthophora* is quite distinct from the now rather numerous species of the subgenus in eastern Asia. The shape of the gonapophysis of the male hypopygium is entirely different from that in the forms hitherto described.

LIMNOPHILA (IDIOPTERA) USSURIANA Alexander.

Limnophila (*Idioptera*) *ussuriana* ALEXANDER, Philip. Journ. Sci. 52 (1933) 142, 143.

NORTHERN KOREA, Ompo, June 9, 1937 (*Yankovsky*).

LIMNOPHILA (ELÆOPHILA) SUBAPRILINA Alexander.

Limnophila (*Ephelia*) *subaprilina* ALEXANDER, Ann. Ent. Soc. America 12 (1919) 340, 341.

NORTHERN KOREA, Ompo, altitude 90 to 100 feet, June 10 to 14, 1937 (*Yankovsky*). Differs from the types chiefly in having the abdominal segments of certain of the specimens less evidently bicolored.

ULOMORPHA NIGRICOLOR Alexander var.

Ulomorpha nigricolor ALEXANDER, Ann. Mag. Nat. Hist. IX 15 (1925) 75, 76.

The unique type, a male, was from Lake Ozenuma, Honshiu, Japan. Northern Korea, Ompo, altitude 600 feet, June, 23, 1937 (*Yankovsky*); two males. These latter specimens are not entirely typical. The dark pattern of the wings is restricted to a long narrow stigma and a narrow seam along cord. Cell R_3 varies from very short-petiolate to entirely sessile. The male hypopygium shows the caudal margin of the tergite produced into two well-produced blackened lobes, separated by a broad U-shaped notch.

HEXATOMA (ERIOCERA) PERNIGRINA sp. nov. Plate 1, fig. 21.

General coloration opaque black, præscutum with four more glabrous stripes; antennæ, halteres, and legs black throughout; wings with a strong blackish tinge, costal border and stigma darker; macrotrichia of veins beyond cord sparse; R_{2+3+4} much shorter than basal section of R_5; m-cu at near midlength of cell 1st M_2.

Male.—Length, about 11 to 12 millimeters; wing, 10 to 11; antennæ, 3.8 to 4.

Female.—Length, about 17 to 18 millimeters; wing, 13 to 14.

Rostrum and palpi black. Antennæ of male 8-segmented, of female 11-segmented; black throughout, scape slightly more pruinose; flagellar segments gradually decreasing in length. Head dull black; vertical tubercle low.

Thorax dull black, præscutum with four more glabrous stripes that are not conspicuous against the ground; vestiture of thorax abundant, erect. Pleura more heavily dusted with brownish gray. Halteres and legs black throughout. Wings (Plate 1, fig. 21) with a strong blackish tinge, costal border and stigma darker; veins dark, less evidently seamed with darker. Macrotrichia of veins beyond cord very sparse, with two or three on each of veins R_3 and distal section of R_5. Venation: Rs long, exceeding R, arcuated at origin; R_{2+3+4} short, a little more than one-half basal section of R_5 and a little less than R_{1+2};

veins R_3 and R_4 weakly divergent at tips; m-cu at midlength of rectangular cell 1st M_2 longer than distal section of vein Cu_1.

Abdomen uniformly dull black. Ovipositor with elongate valves.

Habitat.—Northern Korea.

Holotype, male, Ompo, altitude 450 feet, June 14, 1937 (*Yankovsky*). Allotopotype, female. Paratopotypes, several males and females.

Hexatoma (*Eriocera*) *pernigrina* is allied to regional species such as *H.* (*E.*) *kamiyai* Alexander, *H.* (*E.*) *kariyai* Alexander, *H.* (*E.*) *longifurca* (Alexander), and *H.* (*E.*) *pleskei* Alexander, differing from all in the intensely black color of the body, antennæ, halteres, and legs, and in the strongly blackened but virtually unpatterned wings.

ERIOPTERINI

GONOMYIA (IDIOCERA) PERPALLENS sp. nov. Plate 1, fig. 22; Plate 3, fig. 41.

Allied to *pallens;* general coloration brownish yellow, segments sparsely pruinose, pleura unstriped; legs obscure yellow, outer tarsal segments slightly darker; wings pale grayish yellow, unmarked; Sc_1 ending about opposite midlength of Rs; R_{1+2} and R_3 close together at wing margin; male hypopygium with tergal lobes not developed; middle dististyle with outer arm unusually long and slender.

Male.—Length, about 5 millimeters; wing, 6.

Female.—Length, about 5.5 millimeters; wing, 7.

Rostrum brownish yellow; palpi black. Antennæ with scape and pedicel light yellow, flagellum dark brown; flagellar segments oval to long-oval. Head brownish ochreous.

Mesonotal præscutum pale brownish yellow, sparsely pruinose, with poorly defined darker stripes occupying interspaces behind; scutal lobes weakly darkened; posterior sclerites pale brownish yellow. Pleura pale yellow. Halteres pale, knobs weakly darkened. Legs with coxæ and trochanters pale yellow; remainder of legs obscure yellow, outer tarsal segments slightly darker. Wings (Plate 1, fig. 22) pale grayish yellow, unmarked; veins a little darker than ground. Venation: Sc_1 ending opposite or slightly beyond midlength of Rs; R_{1+2} and R_3 close together at wing margin; petiole of cell 2d M_2 a little exceeding one-third the cell; m-cu more than its own length before fork of M.

Abdominal tergites yellowish brown; sternites and hypopygium yellow. Male hypopygium (Plate 3, fig. 41) with tergal

lobes not developed. Outer dististyle, *od*, a slender simple rod, tip blackened; middle style, *md*, with outer arm unusually long and slender; inner style, *id*, deeply bifid, outer arm acutely pointed and blackened. Ædeagus, *a*, trispinous and blackened at apex, the more basal spine much larger.

Habitat.—Northern Korea.

Holotype, male, Ompo, altitude 150 feet, June 7, 1937 (*Yankovsky*). Allotopotype, female, June 20, 1937. Paratopotype, 1 male, pinned with the holotype.

The nearest relative of the present fly is *Gonomyia* (*Idiocera*) *pallens* Alexander (Japan, Honshiu) which differs in the striped thoracic pleura and structure of the male hypopygium. The conspicuous tergal development of *pallens* is not apparent in the present fly. In *pallens* these arms are very long and conspicuous, only a little shorter than the outer dististyle.

GONOMYIA (GONOMYIA) SUPERBA Alexander var.

Gonomyia (*Gonomyia*) *superba* ALEXANDER, Canad. Ent. 45 (1913) 285, 286.

Widely distributed in Japan.

NORTHERN KOREA, Chonsani, Paiktusan, altitude 4,200 feet, July 24 and 25, 1937 (*Yankovsky*). I cannot separate these specimens specifically from the type material.

ERIOPTERA (ERIOPTERA) PALLIDIVENA sp. nov. Plate 1, fig. 23; Plate 3, fig. 42.

General coloration yellow, præscutum with four brownish stripes; antennæ dark brown; ventral thoracic pleura darkened, dorsal pleura yellow; halteres and legs yellow; wings deep saturated yellow, veins pale, poorly defined against ground; male hypopygium with both dististyles slender, simple, narrowed to acute blackened points; gonapophysis bispinous, inner spine nearly straight, outer spine strongly curved.

Male.—Length, about 5 millimeters; wing, 5.5.

Rostrum yellow; palpi black. Antennæ dark brown, scape a little paler. Eyes (male) large, contiguous beneath. Head infuscated, paling to yellow behind.

Pronotum light yellow. Mesonotal præscutum obscure yellow, with four brownish stripes, intermediate pair darker in front, not reaching suture behind; lateral borders yellow; scutum with lobes extensively infuscated, median area yellow; scutellum light yellow; postnotum obscure yellow, posterior portion of both mediotergite and pleurotergite darker. Pleura with dorsal pleurites and dorsopleural membrane yellow, ventral pleurites, in-

cluding ventral anepisternum, sternopleurite, and meron more infuscated. Halteres yellow. Legs with coxæ yellow, fore coxæ a trifle darker; trochanters yellow; remainder of legs yellow, terminal tarsal segments darkened. Wings (Plate 1, fig. 23) deep saturated brownish yellow, veins pale yellow, very difficult to see against the ground. Venation: Vein M_3 at apex deflected strongly cephalad; vein 2d A strongly sinuous.

Abdomen brownish yellow; hypopygium yellow. Male hypopygium (Plate 3, fig. 42) with basistyles, *b*, slender. Both dististyles slender, simple, of approximately similar outline, narrowed gradually to acute blackened tips; outer style, *od*, glabrous; inner style with a few microscopic setulæ before tips. Gonapophyses, *g*, appearing as flattened plates, each bispinous, inner spine nearly straight, the shorter outer spine strongly curved.

Habitat.—Northern Korea.

Holotype, male, Chonsani, Paiktusan, altitude 4,200 feet, July 16, 1937 (*Yankovsky*).

Erioptera (*Erioptera*) *pallidivena* is quite distinct from the other regional members of the subgenus, differing especially in the body coloration, the pale wing veins, and the structure of the male hypopygium. The only other generally similar species in eastern Asia is *E.* (*E.*) *xanthoptera* Alexander, of Saghalien, which differs in the details of body coloration and in the color and venation of the wings. The male of the latter species is still unknown. Among the European species the fly is closest to *E.* (*E.*) *squalida* Loew, yet is amply distinct.

ORMOSIA (ORMOSIA) DUCALIS sp. nov. Plate 1, fig. 24; Plate 3, fig. 43.

Large (wing, male, over 7 millimeters); general coloration black, including antennæ and legs; halteres with conspicuous light yellow knobs; wings strongly tinged with blackish; cell M_2 open by atrophy of m; vein 2d A nearly straight; male hypopygium with caudal border of tergite moderately produced; three dististyles, outer clavate; gonapophyses appearing as slender, straight rods, tips acute.

Male.—Length, about 6.5 millimeters; wing, 7.2.

Rostrum and palpi black. Antennæ black throughout, of moderate length, if bent backward extending about to wing root; flagellar segments long-oval to elongate, especially the outer ones; longest verticils unilaterally arranged, much exceeding segments in length, especially the more basal ones. Head dull black.

Thorax dull black, pronotum and pleura more pruinose; interspaces with abundant long erect black setæ. Halteres with stem black, knob conspicuously light yellow. Legs black throughout. Wings (Plate 1, fig. 24) with a strong blackish tinge, stigmal region a trifle darker; veins and macrotrichia dark. Macrotrichia of cells unusually abundant and conspicuous (indicated in figure by stippled dots). Venation: Sc_1 ending nearly opposite R_2; Rs subequal in length to Sc_1; R_{1+3+4} short, slightly exceeding R_{2+3}; cell M_2 open by atrophy of m; cells beyond cord deep; vein 2d A nearly straight to very feebly concave.

Abdomen, including hypopygium, black. Male hypopygium (Plate 3, fig. 43) with caudal border of tergite, 9*t*, moderately produced. Three dististyles or primary branches, the outer, *od*, longest, appearing as a dark clavate rod, head scabrous; intermediate style, *md*, about four-fifths as long, blackened, slender, gently sinuous, acute tip strongly curved; inner style, *id*, yellow, compressed, tip obtuse, near base darkened and with numerous setæ. Gonapophyses, *g*, appearing as slender, glabrous, nearly straight rods, tips long and slender, acute, darkened.

Habitat.—Nothern Korea.

Holotype, male, Ompo, altitude 170 feet, May 23, 1937 (*Yankovsky*).

Ormosia (*Ormosia*) *ducalis* is very different from all other species of the genus so far discovered. The open cell M_2, with m lacking, is found also in the otherwise entirely different *O.* (*O.*) *confluenta* Alexander, of Japan.

ILLUSTRATIONS

[**Legend**: *a*, Ædeagus; *b*, basistyle; *d*, dististyle; *dd*, dorsal dististyle; *g*, gonapophysis; *i*, interbase; *id*, inner dististyle; *md*, intermediate dististyle; *od*, outer dististyle; *p*, phallosome; *t*, tergite.]

Plate 1

Fig. 1. *Protanyderus yankovskyi* sp. nov.; venation.
2. *Trichocera tuberculifera* sp. nov.; venation.
3. *Trichocera latilobata* sp. nov.; venation.
4. *Limonia* (*Limonia*) *venerabilis* sp. nov.; venation.
5. *Limonia* (*Dicranomyia*) *infensa* sp. nov.; venation.
6. *Limonia* (*Dicranomyia*) *subaurita* sp. nov.; venation.
7. *Dicranoptycha prolongata* sp. nov.; venation.
8. *Dicranoptycha diacantha* sp. nov.; venation.
9. *Helius* (*Helius*) *polionota* sp. nov.; venation.
10. *Helius* (*Helius*) *gracillimus* sp. nov.; venation.
11. *Pedicia* (*Pedicia*) *lætabilis* sp. nov.; venation.
12. *Pedicia* (*Pedicia*) *simulata* sp. nov.; venation.
13. *Pedicia* (*Tricyphona*) *patens* sp. nov.; venation.
14. *Pedicia* (*Tricyphona*) *longiloba* sp. nov.; venation.
15. *Pedicia* (*Tricyphona*) *diaphanoides* sp. nov.; venation.
16. *Dicranota* (*Rhaphidolabis*) *luteola* sp. nov.; venation.
17. *Dicranota* (*Rhaphidolabis*) *neoconsors* sp. nov.; venation.
18. *Limnophila* (*Phylidorea*) *megapygia* sp. nov.; venation.
19. *Limnophila* (*Phylidorea*) *pernigrita* sp. nov.; venation.
20. *Limnophila* (*Prionolabis*) *acanthophora* sp. nov.; venation.
21. *Hexatoma* (*Eriocera*) *pernigrina* sp. nov.; venation.
22. *Gonomyia* (*Idiocera*) *perpallens* sp. nov.; venation.
23. *Erioptera* (*Erioptera*) *pallidivena* sp. nov.; venation.
24. *Ormosia* (*Ormosia*) *ducalis* sp. nov.; venation.

Plate 2

Fig. 25. *Trichocera tuberculifera* sp. nov.; male hypopygium.
26. *Trichocera latilobata* sp. nov.; male hypopygium.
27. *Limonia* (*Limonia*) *venerabilis* sp. nov.; male hypopygium.
28. *Limonia* (*Dicranomyia*) *infensa* sp. nov.; male hypopygium.
29. *Limonia* (*Dicranomyia*) *subaurita* sp. nov.; male hypopygium.
30. *Dicranoptycha prolongata* sp. nov.; male hypopygium.
31. *Dicranoptycha diacantha* sp. nov.; male hypopygium.
32. *Helius* (*Helius*) *gracillimus* sp. nov.; male hypopygium.
33. *Pedicia* (*Pedicia*) *lætabilis* sp. nov.; male hypopygium, dististyle.
34. *Pedicia* (*Pedicia*) *simulata* sp. nov.; male hypopygium.

PLATE 3

FIG. 35. *Pedicia* (*Tricyphona*) *patens* sp. nov.; male hypopygium.
36. *Pedicia* (*Tricyphona*) *longiloba* sp. nov.; male hypopygium.
37. *Dicranota* (*Rhaphidolabis*) *neoconsors* sp. nov.; male hypopygium.
38. *Limnophila* (*Phylidorea*) *megapygia* sp. nov.; male hypopygium.
39. *Limnophila* (*Phylidorea*) *pernigrita* sp. nov.; male hypopygium.
40. *Limnophila* (*Prionolabis*) *acanthophora* sp. nov.; male hypopygium.
41. *Gonomyia* (*Idiocera*) *perpallens* sp. nov.; male hypopygium.
42. *Erioptera* (*Erioptera*) *pallidivena* sp. nov.; male hypopygium.
43. *Ormosia* (*Ormosia*) *ducalis* sp. nov.; male hypopygium.

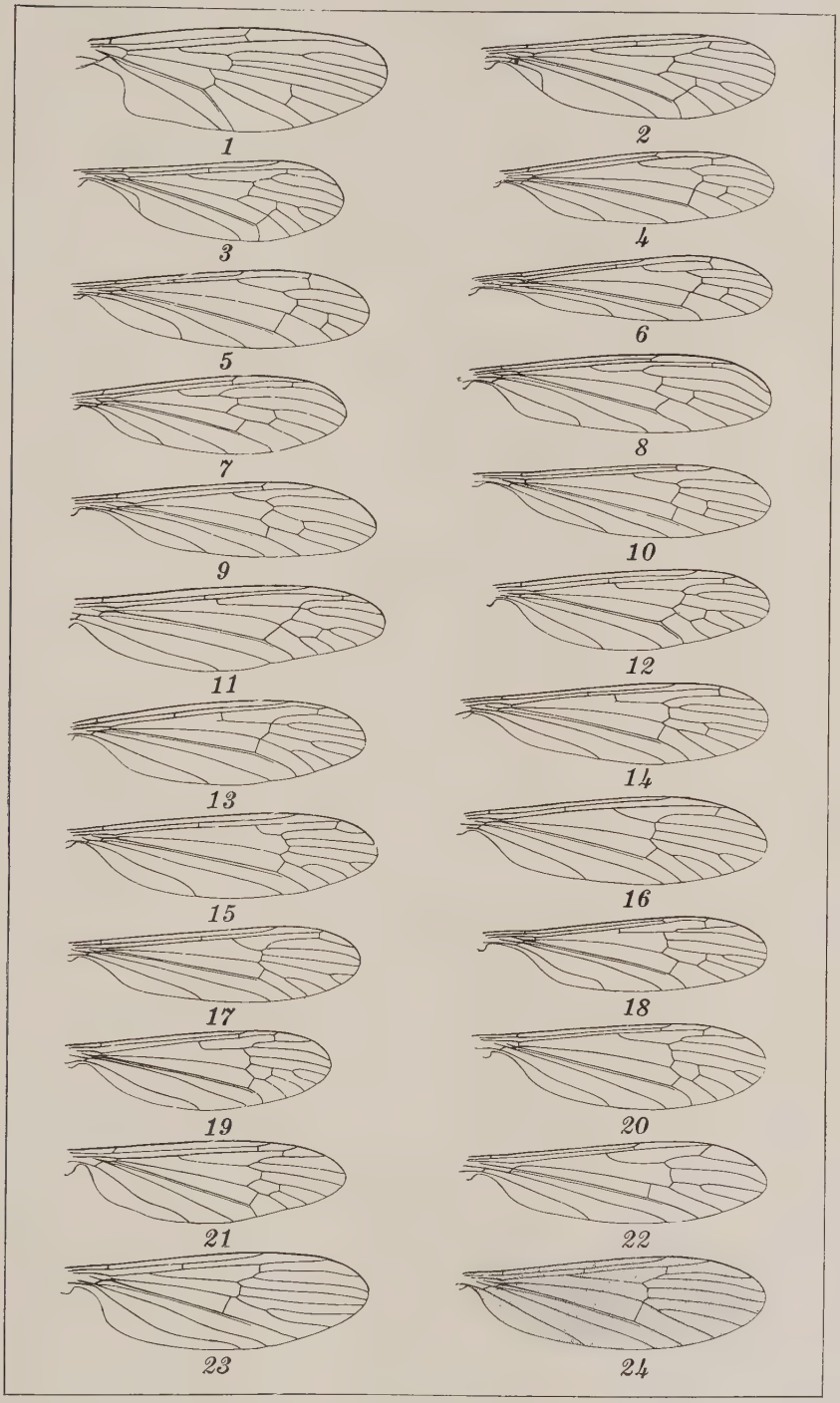

PLATE 1.

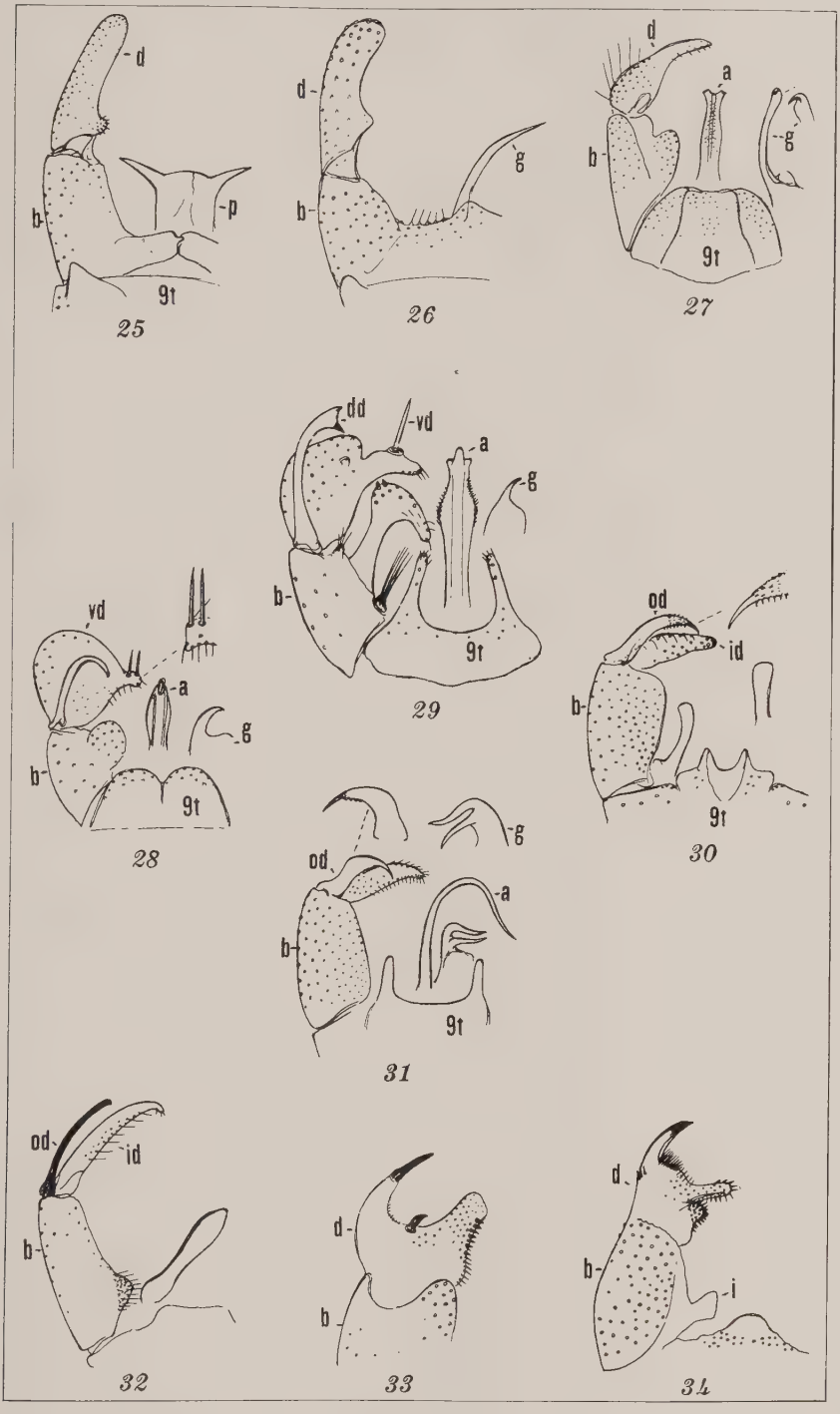
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PLATE 2.

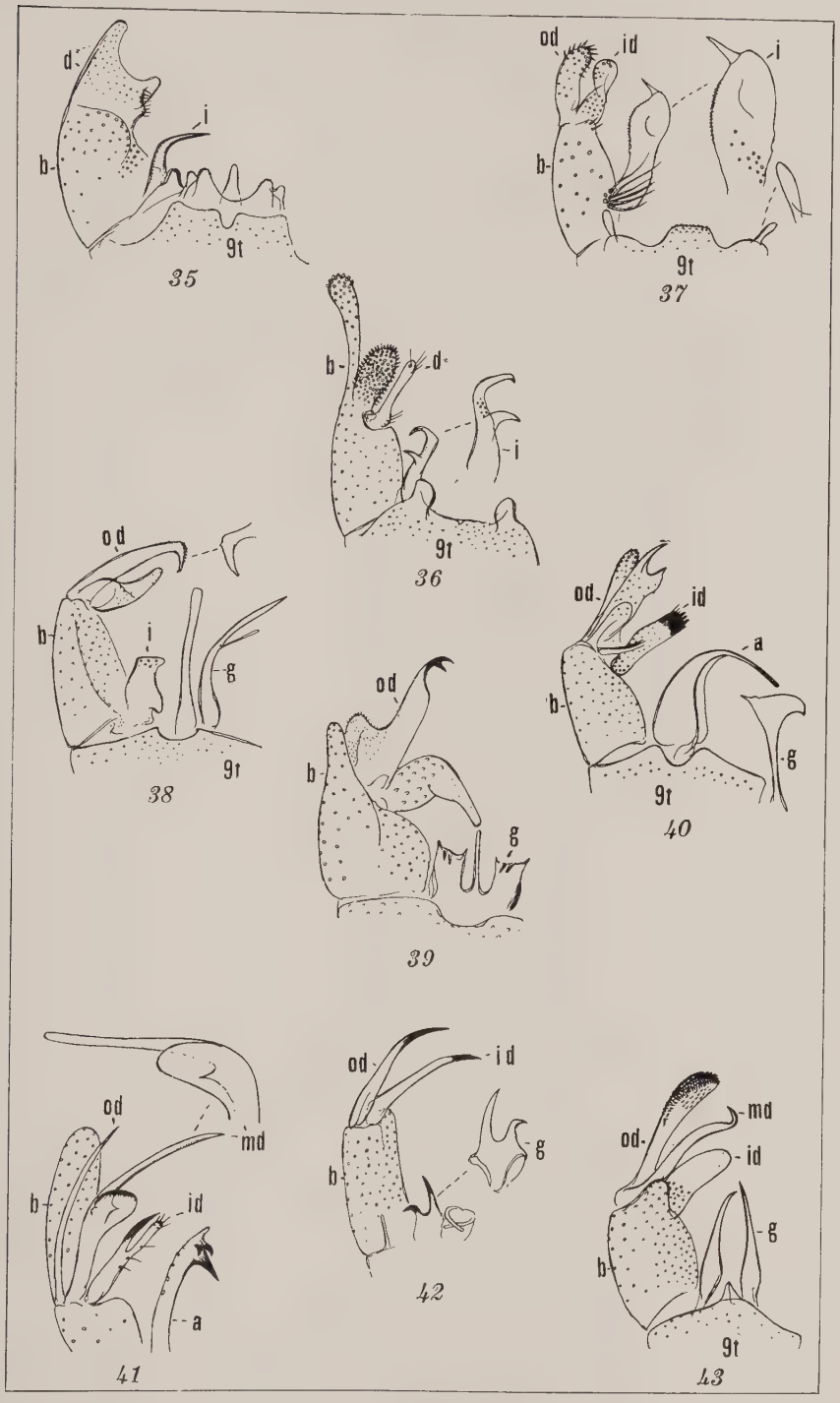
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PLATE 3.

NOTES ON THE ALGAL FLORA OF NEW ZEALAND, I

FRESH-WATER DIATOMS FROM NEW ZEALAND

By B. W. Skvortzow

Of Harbin, Manchoukuo

ONE TEXT FIGURE

In this series I am going to publish various observations I have made on the Algæ of New Zealand, including lists and descriptions of species in smaller collections submitted to me for investigation, essays and observations on biological matters, and other data. During the past 70 years a considerable amount of work has been done on the fresh-water algæ of New Zealand, but our knowledge of their distribution throughout this area still remains very fragmentary and incomplete.

So little attention has been paid to New Zealand fresh-water diatoms hitherto, that only a few papers have as yet been published. As far as I know the first fresh-water diatom samples have been collected in New Zealand by Dr. W. Lauder Lindsay in 1861 in the Greensland district of Otago, around the station or farm of Faitfield, Saddlehill. The determinations of the collection have been made by Dr. R. K. Greville, of Edinburgh, and published by Dr. Lauder Lindsay in 1867.(6, 7) The Lauder Lindsay list contains 110 species, three of which, *Cymbella Lindsayana* Greville, *Stauroneis scaphulaeformis* Greville, and *Stauroneis rotundata* Greville, were described and figured by R. K. Greville.(4, 5) No descriptions and no figures are given in Lauder Lindsay's paper on New Zealand diatoms. As states P. T. Cleve,(2) *Cymbella Lindsayana* Greville [1] is closely connected with *Cymbella Hauckii* of Van Heurck, but the description and figures given by Greville are not sufficient for identification. I could not find the two new *Stauroneis* in the P. T. Cleve monograph, but they were figured in plates 72 and 73, figs. 30, 31, and 32 of the "Diatomaceentafeln zusammengestellt für einige

[1] Trans. Bot. Soc. Edinb. 8: 234, pl. 3, figs. 3–8.

Freunde.(3) These two diatoms, incompletely figured, are distinct species. *Stauroneis scaphulaeformis* Greville in its outline is very similar to *Stauroneis Playfairiana* Skvortzow, recently described as a fossil from neogene deposits in New South Wales, Australia.(10)

The next samples of fresh-water diatoms were collected in New Zealand by Dr. S. Berggren in 1874 and 1875, and distributed in microscopical slides as "Diatoms edited by P. T. Cleve and P. D. Möller" Port 2, Upsala (1898) No. 90, in which the following fossil fresh-water species from Arthur's Pass were published: *Amphora Berggrenii* Cleve, *Navicula rhomboides* Ehr. fo. *gracilis, Navicula Tabellaria* Ehr. fo. *curta, Navicula serians* Kütz. fo. *curta, Navicula firma* Kütz. var., and *Eucyonema gracile* (Ehr.) Rabh.

In 1881 P. T. Cleve published a paper with the description of 3 new diatoms from New Zealand, *Amphora Berggrenii* Cleve, *Stephanodiscus Novae Zealandiae* Cleve, recorded from Roto Rua Lake, and *Triceratium trifoliatum* Cleve, a curious diatom remarkable for its fresh-water habit, and which seems, according to P. T. Cleve, to be most nearly related to *Hydrosera* Wallich from Ganges River in India, but which is entirely different.(1) No diatoms are listed in the paper of Dr. Otto Nordstedt on fresh-water algæ of New Zealand.(8) In P. T. Cleve's monograph on Naviculoid Diatoms 71 different diatoms are reported from New Zealand, with descriptions of the new species *Diploneis subovalis* Cleve from Paeroa, *Gomphonema Berggrenii* Cleve from Waitangi and Roto Rua Lake, *Navicula Pusio* Cleve from Roto Rua Lake collected by S. Berggren, and *Navicula acrosphaeria* Breb. var. *laevis* Cleve.(2) In the paper of Tempere et Peragallo "Diatomees du Monde Entier" published in 1915 several lists of fresh-water diatoms are given from fresh-water deposits of Wangarei, from Roto Teia Lake, Korawara, Waitangi, Auckland, Pakaraka. *Eunotia inaequalis* M. Per. is reported as a new species without figure.(11) The next list of fresh-water diatoms was published by the late G. B. de Toni and Achille Forti in 1923; this material was collected by the reverend dott. Giuseppe Capra in Rotoreia Lake, Wakavareva, Ohinenum, and Port Chermens.(12) In the famous atlas "Dr. A. Schmidt Atlas Diatomaceenkunde" published by the late Dr. Fr. Fricke and now by Dr. Fr. Hustedt, from 1901 to 1914, few New Zealand diatoms were figured. Dr. Fr. Fricke's figures are of *Stephanodiscus Novae Zealandiae* Cleve, plate 225, figs. 33 to

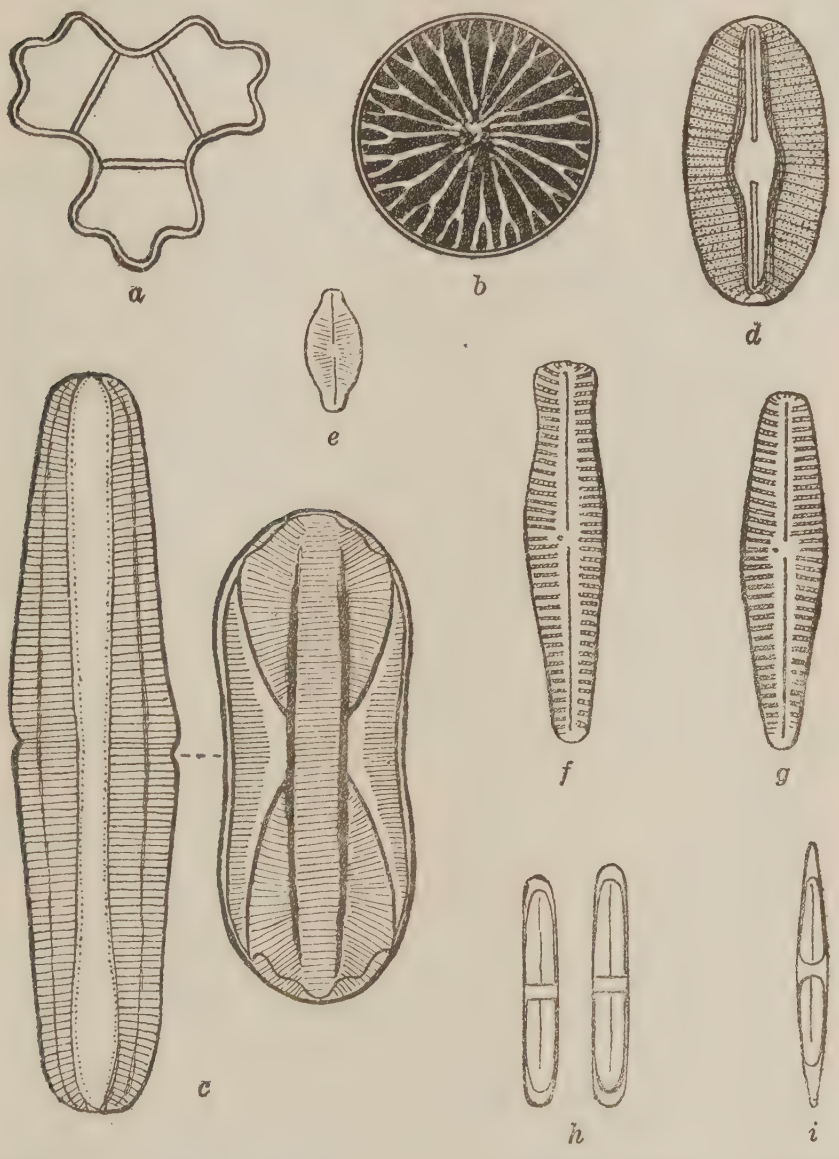

FIG. 1. *a, Triceratium trifoliatum* Cleve (after Cleve) ; *b, Stephanodiscus Novae Zealandiae* Cleve (after Cleve) ; *c, Amphora Berggrenii* Cleve (after Cleve) ; *d, Diploneis subovalis* Cleve (after Cleve) ; *e, Navicula Pusio* Cleve (after Cleve) ; *f, g, Gomphonema Berggrenii* Cleve (after Cleve) ; *h, Stauroneis rotundata* Greville (after Greville) ; *i, Stauroneis scaphulaeformis* Greville (after Greville).

35; *Gomphonema Berggrenii* Cleve, plate 240, figs. 26 to 30; *Gomphonema subclavatum* Grun., plate 240, figs. 31 and 32; *Gomphonema gracile* var. *lanceolata* Kütz., plate 236, figs. 25

to 28, and plate 237, fig. 10; *Gomphonema lanceolatum* Ehr., plate 236, fig. 33. In 1914 Dr. Fr. Hustedt published diagrams of *Eunotia eruca* Ehr., plate 290, fig. 8; *Rhopalodia Novae Zealandiae* Hust., plate 294, fig. 40; and *Synedra ulna* (Nitzsch.) Ehr., plate 301, fig. 11, and plate 302, fig. 2.

As the papers of R. K. Greville, P. T. Cleve, and others are scarce and rare I am giving an account of all fresh-water diatoms provisionally recorded from New Zealand, and several diagrams of rare species. The number after each species corresponds to the locality from which it was obtained. These localities and numbers are as follows: 1, Roto Rua Lake; 2, Korawara; 3, Waitangi; 4, Cabbage-tree swamp, Auckland, from fresh-water deposits; 5, Wangarei, from fresh-water deposits; 6, Auckland, from fresh-water deposits; 7, Pakaraka, from fresh-water deposits; 8, Wakavareva; 9, Ohinemutu; 10, Port Chalmers; 11, Paeroa; 12, Bluff; 13, New Zealand reported by P. T. Cleve; 14, Otago, by W. S. Lindsay. I have left the original nomenclature of the authors. This nomenclature has in many places grown old, and as all diatoms have not been figured in the reports it is impossible now to correct the names.

DIATOMS RECORDED FROM FRESH WATERS OF NEW ZEALAND

Triceratium trifoliatum Cleve, 13.
Melosira crenulata Kütz., 1, 3, 6, 7, 8.
Melosira crenulata var. *tenuis*, 3.
Melosira crenulata var. *ambigua* Grun., 2.
Melosira crenulata var. *valida* Grun., 6.
Melosira granulata (Ehr.) Ralfs, 5, 9.
Melosira granulata var. *decussata* (Ehr.) Grun., 1, 9.
Melosira laevis Ehr., 4.
Melosira Roeseana Rab. var., 4.
Melosira Roeseana var. *epidendron*, 4.
Melosira subflexilis Kütz., 14.
Melosira orichalcea Mert, 14.
Lysigonium varians de Toni, 1, 3, 8, 14.
Stephanodiscus Novae Zealandiae Cleve, 1, 8, 9.
Cyclotella steligera Cleve et Grun., 1, 8.
Cyclotella operculata Kütz., 14.
Cyclotella Kützingiana Thw.?, 14.
Cyclotella punctata Sm., 14.
Cyclotella minutula, 14.
Hyalodiscus subtilis Bail., 14.
Actinoptychus undulatus K., 14.
Denticula tenuis K., 14.
Odontidium mutabile Sm., 14.
Fragilaria capucina Desm., 14.
Meridion constrictum Ralfs, 3, 14.
Meridion circulare Grev., 14.
Synedra acus Kütz., 1.
Synedra ulna (Nitz.) Ehr., 1, 5, 8, 9, 14.
Synedra ulna var. *lanceolata* (Kütz.) Grun., 8.
Synedra ulna var. *oxyrhynchus* (Kütz.) Grun., 8.
Synedra ulna var. *oxyrhynchus* fo. *mediconstricta* Forti, 4.
Synedra ulna var. *longissima*, 4.
Synedra rumpens Kütz., 4.
Synedra rumpens var. *fragilaroides*, 4.

Synedra minutissima K., 14.
Synedra radians K., 14.
Synedra delicatissima Sm., 14.
Synedra tenera Sm., 14.
Synedra acuta Ehr., 14.
Synedra fasciculata Ag., 14.
Eunotia serpentina Ehr., 8.
Eunotia pectinalis (O. Müll.) Rabh., 8, 14.
Eunotia veneris Kütz., 1, 9.
Eunotia gracilis Sm., 14.
Eunotia impressa Grun., 3.
Eunotia inaequalis M. Per., 3.
Eunotia lunaris Grun., 3.
Eunotia lunaris var. *alpina*, 3.
Eunotia lunaris var. *major*, 3.
Eunotia lunaris var. *subarcuata*, 3.
Eunotia diodon Ehr., 1, 4, 6.
Eunotia ophidacampa Cleve, 1.
Eunotia Burkartii Ehr., 4.
Eunotia major Rab., 4.
Eunotia monodon Ehr., 4.
Eunotia monodon fo. *curta*, 4.
Eunota parallela Ehr., 4.
Eunotia praerupta var. *bidens*, 4, 7, 14.
Eunotia eruca Ehr., 6.
Dictomella Balfouriana Grev.
Cocconeis placentula Ehr., 1, 3, 5, 8, 9, 14.
Cocconeis pediculus Ehr., 14.
Achnanthes exilis K., 14.
Achnanthes inflata (Kütz.) Grun., 4, 7, 8.
Achnanthes Hauckiana Grun., 13.
Achnanthes lanceolata (Breb.) Grun., 4, 6, 7, 8, 14.
Achnanthes lanceolata var. *inflata* A. Mayer, 8.
Achnanthes exigua Grun., 13.
Achnanthidium lineare Sm., 14.
Achnanthidium coarctatum Breb., 14.
Achnanthidium trinode Arn., 14.
Rhoicosphenia curvata (Kütz.) Grun., 13.
Frustulia rhomboides Ehr., 1, 3, 8, 14.
Frustulia rhomboides var. *lanceolata* Ehr., 13.
Frustulia vulgaris Thw., 3, 8, 14.
Frustulia vulgaris var. *saxonica* Rabh., 13.
Gyrosigma Kützingii Grun., 13.
Gyrosigma acuminatum (Kütz.) Rab., 8.
Caloneis fasciata Lagerst., 13.
Caloneis silicula Ehr. var. *genuina* Cleve, 13.
Caloneis silicula var. *ventricosa* Ehr.) Donk., 4.
Neidium affine Ehr., 2, 4, 14.
Neidium affine Ehr. var. *amphirhynchus* Ehr. fo. *major*, 5, 13.
Neidium Hitchcockii Ehr., 13.
Neidium bisulcatum, 14.
Neidium dubium Ehr., 1, 8, 9, 13.
Neidium iridis, 14.
Diploneis elliptica Kütz., 1, 8, 14.
Diploneis subovalis Cleve, 11.
Stauroneis Frauenfeldiana Grun., 2, 13.
Stauroneis acuta W. Smith, 8, 13.
Stauroneis Fulmen Btw., 2, 13.
Stauroneis anceps Ehr., 1, 3, 8, 14.
Stauroneis anceps var. *gracilis* (Rab.) Brun., 8, 14.
Stauroneis anceps var. *linearis* Ehr., 14.
Stauroneis phoenicentron Ehr., 3, 5, 14.
Stauroneis javanicum Grun., 4.
Stauroneis scaphulaeformis Grev., 4, 14.
Stauroneis rotundata Grev., 14.
Stauroneis constricta Ehr., 14.
Stauroneis platystoma Ehr.
Pleurostauron inflatum (Heid.) de Toni et Forti, 8.
Mastogloia lanceolata Thw., 14.
Colletonema neglectum ? Thw., 14.
Navicula pupula Kütz., 1, 5, 9, 13.
Navicula bacilliformis Grun., 4.
Navicula pseudo-bacillum Grun., 13.
Navicula pusio Cleve, 1.
Navicula vulpina Kütz., 13.
Navicula salinarum Grun. var. *intermedia* Grun., 13.
Navicula lacunarum Grun., 4.
Navicula gastrum Ehr., 13.

Navicula gastrum var. *exigua* Greg., 13.
Navicula placenta Ehr., 13.
Navicula placentula Ehr., 5, 8, 13.
Navicula radiosa Kütz., 3, 14.
Navicula cuspidata Kütz., 2, 5, 13.
Navicula cuspidata var. *ambigua* Ehr., 13.
Navicula cuspidata var. *creticula*, 14.
Navicula rhynchocephala Kütz., 1.
Navicula rhynchocephala var. *amphiceros* (Kütz.) Grun., 8.
Navicula commutata Grun., 4.
Navicula peregrina Kütz., 5, 14.
Navicula mutica var. *Cohnii*, 7.
Navicula laevissima K., 14.
Navicula cocconeiformis Greg., 14.
Navicula claviculus Greg., 14.
Navicula inflata K., 14.
Navicula pusilla Sm., 14.
Navicula cryptocephala K., 14.
Navicula lanceolata Ag., 14.
Navicula tumida Breb., 14.
Pinnularia mesolepta Ehr., 8, 13, 14.
Pinnularia divergentissima Grun., 13.
Pinnularia Legumen Ehr., 13.
Pinnularia divergens W. Sm., 2, 3, 4, 13.
Pinnularia divergens var. *sublinearis* Cleve, 13.
Pinnularia episcopalis Cleve, 2.
Pinnularia episcopalis Cleve var. *brevis* Cleve, 13.
Pinnularia borealis Ehr., 3, 13, 14.
Pinnularia lata Breb., 1, 8, 13.
Pinnularia stauroptera Grun., 2.
Pinnularia stauroptera var. *interrupta* Cleve, 13.
Pinnularia stomatophora Grun., 13.
Pinnularia subsolaris Grun. var. *linearis* Cleve, 13.
Pinnularia hemiptera Kütz., 3, 6, 13.
Pinnularia acrosphæria Breb., 4.
Pinnularia acrosphæria Breb. fo. *maxima*, 13.
Pinnularia acrosphæria var. *laevis* Cleve, 13.
Pinnularia parva Greg., 3, 6, 8, 13.
Pinnularia parva var. *Novae Zealandiae* Cleve, 13.
Pinnularia major Kütz., 1, 2, 4, 6, 8, 13, 14.
Pinnularia viridis Nitz., 2, 4, 6, 8, 13, 14.
Pinnularia distinguenda Cleve, 13.
Pinnularia gibba, 3, 4, 6, 14.
Pinnularia gibba var., 3.
Pinnularia brevistriata Grun., 2.
Pinnularia legumen Ehr., 1.
Pinnularia appendiculata (Ag.) Cleve, 8.
Pinnularia appendiculata var. *budensis* Grun., 1.
Pinnularia dactylis Ehr., 8.
Pinnularia Hartleyana Grun., 8.
Pinnularia brevicostata Cleve var. *interrupta*, 4.
Pinnularia transversa AS., 4.
Pinnularia acuminata Sm., 14.
Pinnularia viridula Sm., 14.
Pinnularia stauroneiformis Sm., 14.
Pinnularia interrupta Sm., 14.
Pinnularia subcapitata Greg., 14.
Amphora ovalis (Breb.) Kütz., 8, 14.
Amphora ovalis var. *pediculus* Kütz., 13.
Amphora veneta Kütz., 13.
Amphora Berggrenii Cleve, 13.
Cymbella ventricosa Kütz., 3, 4, 6, 8, 13.
Cymbella cuspidata Kütz., 13, 14.
Cymbella cuspidata var., 2.
Cymbella affinis Kütz., 1, 13.
Cymbella anglica Lag., 1.
Cymbella gastroides Kütz., 1.
Cymbella amphicephala Naeg., 8.
Cymbella australica (A. Sch.) Grun., 8, 13.
Cymbella Cesatii (Rab.) Cleve, 8.
Cymbella parva (W. Sm.) Cleve, 8.
Cymbella pusilla Grun., 4.
Cymbella turgidum Grun., 4, 13.
Cymbella naviculiformis Auerst., 13.
Cymbella Jordani Grun., 14.
Cymbella gracilis Rabh., 13.
Cymbella sinuata Greg., 13.
Cymbella turgidula Grun., 13.

Cymbella aspera Ehr., 13.
Cymbella tumida Breb., 13.
Cymbella apiculata, 14.
Cymbella Lindsayana Grev., 14.
Cymbella obtusiuscula K., 14.
Cymbella Helactica K., 14.
Cymbella lanceolatum Ehr.
Gomphonema parvulum Kütz., 7, 8, 13.
Gomphonema gracile Ehr., 1.
Gomphonema gracile. var. *major* Grun., 13.
Gomphonema gracile var. *naviculacea* W. Sm., 13.
Gomphonema lanceolatum Ehr., 13.
Gomphonema acuminatum Ehr., 13.
Gomphonema Berggrenii Cleve, 1, 2, 3, 8.
Gomphonema constrictum Ehr., 13, 14.
Gomphonema intricatum, 6, 14.
Gomphonema intricatum var. *pumila*, 3.
Gomphonema subclavatum Grun, 4.
Gomphonema affine Kütz., 4.
Gomphonema vibrio Ehr., 4, 14.
Gomphonema curvatum K., 14.
Gomphonema cristatum Rab., 14.
Gomphonema augur Ehr., 14.
Gomphonema tenellum K., 14.
Gomphonema dichotomum K., 14.
Gomphonema aequale Greg., 14.
Epithemia sorex Kütz., 1, 3, 5, 8, 12, 14.
Epithemia turgida (Ehr.) Kütz., 8, 14.
Epithemia zebra (Ehr.) Kütz., 10, 14.
Epithemia musculus Kütz., 14.
Epithemia Westermanniae Ehr., 14.
Rhopalodia gibba (Ehr.) O. Müll., 1, 9, 14.
Rhopalodia ventricosa (Ehr.) O. Müll., 8.
Rhopalodia gibberula (Ehr.) O. Müll., 1, 3, 9.
Rhopalodia Novae Zealandiae Hust.[3]
Hantzschia amphioxys (Ehr.) Grun. 1, 6, 7, 9, 14.
Hantzchia amphioxys var. *intermedia* Grun., 12.
Nitzschia amphibia Grun., 1, 7, 9.
Nitzschia dubia W. Sm.
Nitzschia Frauenfeldii Grun., 1, 9.
Nitzschia linearis (Ag.) W. Sm., 1, 9.
Nitzschia obtusa W. Sm. var. *scalpelliformis* Grun., 1.
Nitzschia palea, 1.
Nitzschia sigma (Kütz.) W. Sm., 10, 12.
Nitzschia thermalis (Ehr.) Auer., 1, 9.
Nitzschia spectabilis Ralfs, 2.
Nitzschia acutiuscula Grun., 4.
Nitzschia sigmoidea W. Sm., 4, 14.
Nitzschia parvula Sm?, 14.
Nitzschia minutissima Sm., 14.
Nitzschia spathulata Breb., 14.
Triblionella gracilis Sm., 14.
Triblionella debilis Ryl., 14.
Triblionella angustata Sm., 14.
Triblionella levidensis Sm., 14.
Surirella gracilis Grun., 8.
Surirella ovalis Breb., 2, 3, 9.
Surirella ovalis var. *angusta* (Kütz.) Van Heur., 1, 8, 9.
Surirella ovalis var. *excelsa* O. Müll., 1.
Surirella ovalis var. *Kotschyana*, 3, 8, 13.
Surirella splendida (Ehr.) Kütz., 3, 8, 14.
Surirella linearis Sm., 14.
Surirella linearis var. *constricta*, 3.
Surirella minuta Breb., 3, 14.
Surirella ovata Kütz., 3, 14.
Surirella biseriata Breb., 14.
Surirella tenera Greg.
Surirella elegans, 14.
Campylodiscus cribrosus Sm.

[3] A Schmidt, Atlas Diatom. pl. 294, fig. 40.

This list contains 259 different diatoms reported from New Zealand of which 14 are endemic. Several forms seem to me brackish-water species.

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ILLUSTRATION

TEXT FIGURE

FIG. 1. *a*, *Triceratium trifoliatum* Cleve (after Cleve); *b*, *Stephanodiscus Novae Zealandiae* Cleve (after Cleve); *c*, *Amphora Berggrenii* Cleve (after Cleve); *d*, *Diploneis subovalis* Cleve (after Cleve); *e*, *Navicula Pusio* Cleve (after Cleve); *f*, *g*, *Gomphonema Berggrenii* Cleve (after Cleve); *h*, *Stauroneis rotundata* Greville (after Greville); *i*, *Stauroneis scaphulaeformis* Greville (after Greville).

THE FLYING-FISH INDUSTRY OF THE NORTHWESTERN AND SOUTHWESTERN COASTS OF CEBU

By CLARO MARTIN

Of the Fish and Game Administration, Bureau of Science, Manila

FOUR PLATES

The flying-fish industry of Cebu first came to the notice of the writer during his preliminary survey of the fisheries of Fishery District No. 8 (comprising Oriental Negros, Cebu, and Bohol Provinces) in May and June, 1936. The particulars obtained at that time were supplied exclusively by the fishermen. An opportunity to check up on this information came in November, 1936, when the investigation reported in the present paper was conducted.

The flying-fish fishery on the southeastern coast of Cebu has been in existence for about 40 years. It was originated by the Dalaguetnons (natives of the town of Dalaguete). Floating *bobos,* or fish pots, were first used. After years of observation of the habits of the flying fish the gill-net method was evolved. The gill net used is the *natural.*

The range of the flying-fish fishery in this part of Cebu is from San Fernando southward to Oslob. Fishing is most intensive in Dalaguete. It appears that years of unrestrictive fishing have caused the flying-fish fishery of this region to decline. This condition, together with the increase in the number of fishermen, made it necessary for the Dalaguetnons to look for new fishing grounds, and they were the first to fish the "voladors" (flying fish) in the towns of Balamban, Asturias, and Tuburan in northwestern Cebu, in southwestern Oriental Negros Province, and in southern Bohol Province. In 1936 many fishermen from Dalaguete went to fish in Leyte and Samar Islands, bringing their nests with them.

In places where this fishery exists, fishing for the more common commercial species is generally poor, for the coast line is abrupt and the water deep.

SPECIES TAKEN

This fishery is not confined to fishing for a single species. While the fishery is devoted primarily to flying fish, half-beaks

are also caught in appreciable quantities. A few needle fish are also caught now and then.

The bulk of the catch of flying fish is made up of *baroñgoy,* There are two species that fall under the name of baroñgoy, *Cypselurus poecilopterus* and *Cypselurus olegolepis.* Flying fish over 20 centimeters long are called *bangse.* Of the two species of baroñgoy, *C. oligolepis* forms the major part of the catches. This is true in northwestern as well as in southwestern Cebu.

Mixed with the baroñgoy is another species of flying fish, with a much abbreviated pectoral, *Evolantia micropterus,* locally called *laniw.* In most cases laniw does not constitute even 1 per cent of the whole catch in Tuburan. Apparently the same is true in southwestern Cebu.

Cypselurus bahiensis, called *sirikinia,* is another species of commercial flying fish. This species can be distinguished from the others by its smaller and shorter head and its long pectoral, the tip of which when folded comes closer to the base of the caudal than those of any other species. Sirikinia is found mostly in southwestern Cebu, where it is caught by means of a special kind of net and fish pot or bobo.

Species other than the flying fish are also caught. There are times when as much as one third of the catch consists of halfbeaks, or *soacid, Hemiramphus far.* A few needlefish or *bao, Belone sp.,* are also caught.

The catch is generally segregated into three groups. Group 1 includes the large-sized flying fish, from 191 to 270 centimeters long. Group 2 includes fish from 141 to 190 centimeters long. To group 3 belong the small fish, from 91 to 140 centimeters long. If there are plenty of halfbeaks of group 1 or group 2 size they are segregated as group 4. However, if these are very few and are of the same size as those of the first two groups, they are just mixed with these respective groups according to size.

The percentage of group 1 in the catch ranges from 5 to 65. The group 2 size generally predominates in the catch, with a percentage range of from 70 to 90. When group 1 predominates, the percentage of group 2 may be as low as 27. However, this condition occurs only occasionally. For group 3 the range is 2 per cent to 9 per cent. Group 4, if it is represented at all in the catch, includes 4 per cent to 20 per cent of the fishes caught.

FISHING SEASON

In the towns of Balamban and Tuburan, in northwestern Cebu, the fishing season starts in August and ends in March. Although good weather prevails from April to July, fishing activities are suspended during these months. It has been observed that during this period the fish are generally of group 1 size. Although the fishing season starts in August, when the majority of the fish have attained group 2 size, fishing activities are limited at this time by unfavorable weather conditions due to the southwest monsoon. Brisk fishing begins in October and ends in March.

In the towns of Argao, Dalaguete, Bolhoon, and Oslob in southwestern Cebu, the fishing season for all kinds of flying fish falls within the period from June to March. Barongoy are plentiful during June, July, August, and September. Fishing activities, however, are limited during July and August by unfavorable weather due to the southeast monsoon. The fishing season for sirikinia lasts from October to December.

FISHING METHODS

Bobo.—Ordinarily the bobo, or fish pot, is used under water for catching bottom species. Fishermen in southeastern Cebu use the same trap, provided, however, with floats to catch the flying fish, which are surface species.

The bobo is a boxlike structure, made in the shape of a rectangle from mats of thin split bamboo, woven with an open hexagonal mesh of about 2 centimeters. On the top are fastened three 1-joint bamboo floats to keep the trap close to the surface of the water. The entrance is made on one of the sides in such a way that the fish cannot escape once it has entered the trap. At the side opposite the entrance a sort of door is provided to facilitate the removal of the fish inside the trap.

When the trap is taken out for fishing, small bunches of seaweeds, *samo,* are tied to the sides and top to simulate a bunch of floating seaweed to attract the flying fish, particularly the sirikinia. The trap is fastened to the baroto of the fishermen with a 50-meter line.

Gill net.—Two types of gill nets are used, the one-man gill net and the large gill net. Both types of net are called panirikinia.[1]

[1] Net for catching sirikinia.

The one-man type is a small gill net, 4 meters deep and 14 meters long. This net is home-made, woven from No. 40 thread with a 3.4 cm (stretched) mesh. This net is provided with floats, 4 cm in diameter, 14 cm long, and 30 centimeters apart. Stone weights set 45 centimeters apart are used on the lead line. The net is dyed light blue.

The other type of panirikinia is a large net, composed of 10 pieces of the same material and made like the one-man panirikinia. The pieces, measuring 7 meters each, are interlaced end to end.

The operation of this net requires seven to twelve *barotos*.[2] One of these barotos, called *pukutan*, is large, and manned by two men. The net is carried in this baroto. The other barotos are small and manned each by a single individual. One of these serves as the *lawitan*, the boat in which one end of the net is accommodated. In actual fishing the man on the lawitan takes charge of one end of the net. The rest of the men are called *abugan*, or drivers. There must be at least five abugan.

Fishing is done at daytime, always in the morning. The fishermen start for the fishing ground at dawn. At the fishing ground the net is spread across the current, which must not be very strong. One end of the net is dropped from the pukutan and picked up by one man on the lawitan, who ties it to the baroto. Then both the pukutan and the lawitan are steered in opposite directions until the entire length of the net is spread out. The abugan deployed in the form of a semicircle by this time are about a mile or more away from the net, moving toward the net and driving the flying fish toward it by throwing stones forward to scare the fish.

Pamaroñgoy.—The pamaroñgoy [3] is a purse seine. This seine varies in length from 230 to 300 meters and is 16 meters or more deep at the bunt. It is provided with a 7-mesh selvage of No. 40 [4] netting all around.

The net is composed of two parts, the wings, or *palispis*, and the bunt, or *siguin*. The length of the wing portion varies from 70 to 80 meters. The netting used in the wings is handwoven from No. 20 thread with a mesh of 2.5 centimeters. The bunt is composed of five parts. The middle portion is of No. 4 net-

[2] A narrow canoelike boat with a high sharp cutwater, provided with outriggers, and invariably fitted with a sail.

[3] Net for catching baroñgoy.

[4] The numbers of the twines and netting mentioned here are taken from the Aguinaldo Catalogue.

ting with a mesh of 1.7 centimeters. Next to this on each side is a strip of No. 21 netting of 1.5 centimeters mesh but of lighter twine. This strip is followed on the outer edge on each side by another of No. 29 netting of 2 centimeters mesh.

The middle portion of the bunt is the deepest part of the net—16 meters from the float line down to the lead line. From this portion the net narrows toward the end of the wing which is 6 meters wide. A wing briddle provided with a loop is fastened at the end of the wing. At the wings the floats are small, 6 centimeters in diameter and 7.5 centimeters long, and placed at intervals of 30 to 40 centimeters. At the bunt the floats are larger, 9 centimeters in diameter and 14.5 centimeters long. The floats are closer together at the middle portion of the bunt. Baked clay weights, 4 by 3 centimeters and spaced at intervals of 37 to 40 centimeters, serve as leads. Hanging by means of a strong twine 20 to 37 centimeters long from the lead line are the brass rings, 7 centimeters in diameter. There are altogether 54 of these brass rings, spaced at intervals of 1.40 meters to 1.65 meters. There are two purse lines, one end of each of which is fastened to the middle of the lead line. From there the two purse lines run in opposite directions, passing through the rings. The other ends of the purse lines are then tied each to the farthest ring directly fastened to the lead line about 30 meters from the end of the wing.

The operation of this net requires at least fifty men. One large sailboat (*banca*), a fast delivery sailboat (*tumuran*), a three-passenger baroto for lawitan, and at least twenty small barotos for abugan, are used. The banca, manned by ten men, is used to carry the net to the fishing ground. The men here include the leader of the entire outfit. The tumuran is included among the barotos used by the drivers. Speed is the important characteristic of a tumuran for delivering the catch to the shore. The lawitan is the baroto used by three men who take care of one end of the net when spread.

At about 2.30 A. M. the leader of the outfit begins to sound the call for his men with his shell (*turbo*) trumpet, locally called *budiong*. Each outfit has its distinctive call notes. After half an hour the banca and the lawitan leave the shore for the fishing grounds. The banca is equipped with a signal lamp for the abugan to follow, and the leader keeps sounding the outfit's call on the shell trumpet to keep the rest of the outfit aware of the banca's position.

The drivers in their respective barotos leave the shore usually about an hour later, when the banca is already quite far away. Before the sun rises, or even earlier, the drivers, arranged in a large semicircle, advance toward the position of the banca. They then begin to drive the unseen fish by throwing stones sideways and forward as they advance.

At the sight of the approaching drivers the leader orders the spread of the net. Two men pay out the piled net while one sees to it that it is not twisted. As the net is paid out, the banca is rowed forward and steered into a position that will not interfere with the spread of the net. The other end of the net is taken by a man in the lawitan who ties the *bahan,* or scare line, to the loop of the bridle line. The bahan is a 0.5-inch hemp rope about 100 meters long, with bury palm fronds inserted through the strands at intervals of about 1 meter. The other end of this scare line is fastened to the base of the mast of the lawitan. Before the other end of the net is let out, one end of the other scare line is fastened to the loop of the bridle line and the other end to the base of the mast of the banca. In the resulting position the net takes the shape of an arc, with the banca at one end and the lawitan at the other. Stones are thrown every now and then in the direction of the scare line and the gap between the men and the approaching leader of the drivers. As the drivers advance towards the net, they close and complete the circle. The circle is made smaller and smaller as the drivers advance toward the net to take hold of the float line. Others tie their barotos to the scare line and take to the water with their diving goggles to see to it that the fish do not escape. Meanwhile the banca and the lawitan approach each other. A 10-meter rope from the lawitan is fastened to the prow of the banca. The scare lines by this time are being pulled in. When the bridle line is reached at the lawitan this end of the net is passed to the men at the prow of the banca, where it is hauled in; the other end is collected at the middle portion of the banca. When the ends of the purse lines come to hand they are unfastened from the ring and slipped through the pursing blocks of the purse weight or tom (*lingote*). The latter is then immediately lowered and suspended from a purse weight line about 8 meters below the banca. As soon as this is done the purse lines are pulled in while the ends of the net are hauled in. When the bottom of the bunt is already pursed, the purse lines and the purse-weight line are pulled together to

bring the lead line of the bunt to the banca. The bunt is made smaller and smaller as the net is collected on the banca. The flying fish are dipped from the bunt right into jute sacks. A small portion is left for the fishermen to divide among themselves.

As soon as the fish are placed in the sacks, these are placed on the tumuran which rushes them to the shore. If another haul of the net is made, the second fastest sailboat in the outfit delivers the catch to the shore.

HANDLING AND MARKETING

As it takes but a short time—an hour to an hour and a half—for the tumuran to get to the shore, the fish is subjected to no special handling in transit.

Upon arrival at the shore the tumuran is met by the women retail vendors who vie with each other in the acquisition of the fish first landed, as these command a higher price on the market.

The sacks in which the fish are carried are not uniform in size; they range from the smallest, with a capacity of about 2,000 flying fish of group 2 size, to the largest, with a capacity of about 3,000.

When the catch is abundant, the fish are sold by the sack, but if it is meager they are sold by the hundred. The price ranges from 5.50 pesos [5] to 6 pesos per sack of 1,900 to a little over 2,000 fish. During scarcity the price per hundred goes up to 50 centavos, and the fish are retailed 8 fish of group 2 for 5 centavos and 3 fish of group 1 for 5 centavos. During the peak of the catch in 1935 the price level is said to have gone down to as low as 40 centavos per petroleumcanful, about one-fourth the capacity of one sack of the kind ordinarily used.

When the catch is plentiful the fish are shipped to neighboring towns.

PRESERVATION

When the catches are not entirely disposed of by 3 P. M. the surplus is preserved in various forms.

Pinakas.—In this method of preservation the fish is split on the back from the mouth down to the base of the tail, and the entrails removed. Then, after the fish has been washed, it is salted and laid flat on the belly in layers in a container. The following day and thereafter the salted fish are dried under the sun.

[5] One peso equals 50 cents United States currency.

Tinabal.—In this method the fish are thoroughly mixed with salt, and placed in gasoline or petroleum cans with a thick layer of salt on top. The fish are thus allowed to remain in their own pickle.

Tinapan.—According to the tinapan method the fish are washed and strung through the eyes with rods about 1 meter long. Each rod carries 25 to 28 fish.

The strung fish are then placed over smoldering coconut fuel to be roasted. The arrangement is changed at least 4 times in order to give the fish a uniform cooking and coloration. It takes an hour or less to complete the cooking.

The process renders the fish hard and practically dry. The product is known to keep for a week at most.

NOTES ON THE SPAWNING HABITS OF FLYING FISH

In Tuburan fishermen have observed that in April, May, and June the flying fish caught are generally small—10 centimeters long at most. These fingerlings are probably hatched about December or January. In November adults (group 1) of *Cypselurus* in Tuburan were found to have mature ova, and the ova of group 2 fish are in the process of development. November 18, 1936, while taking measurements of the pamarongoy net, the writer in several parts of the net came across clusters of eggs entangled in a mass of long tough filaments. Upon close examination these eggs were found to bear close resemblance to those found and described by Hornell from Coromandel Coast.[6] He says:

> The proof was plain; the branches and leaves of the shrub were full of tangled-up multitudes of tiny colourless eggs with innumerable glassy threads, tough and elastic, attaching them in mosses to one another and also the leaves and branches of the plant. The eggs were devoid of colour, transparent save at one pole, where a tiny opaque white disk, the blastoderm area, was distinguishable.

A detailed microscopic examination and observation of the development of the eggs by Hornell were made by Nayadu[7] who gave the following:

> They are almost spherical, 1.75 to 1.8 mm. in diameter, and are very tough and resilient, rebounding like an indiarubber ball when struck against any hard surface.

[6] Hornell, James. The Flying-fish Fishery of the Coromandel Coast. Bull. No. 15, Fishery Reports for 1922, Madras Fish. Dept. (1923) 99–108.

[7] Nayadu, M. Ramaswani. A note on the eggs and early embryonic development of *Cypselurus*. Ibid., 109–112.

They are attached to floating objects and to one another by means of hyaline filaments issuing from the surface of the egg membrane. These filaments are of three kinds; first, one single filament, the stoutest and the longest, which is the egg's main anchoring cable; second, a tuft of 7 to 16 tiny thin short ones exactly at the opposite pole, and third, 4 to 6 medium-sized ones which form side stays. The function of the tuft of tiny filaments is not known as in all the eggs examined they were free and unattached. The egg is very slightly elongated towards the pole from which the stout long filament issues. When the eggs are attached only to one another the main and the side stays are plaited together to form a stout central cord of considerable length, consisting of several thin filaments, from which the eggs project on all sides in the manner of grapes in a bunch in which case the stem of the bunch will represent the stout central cord of the mass of eggs.

Cypselurus species in southwestern Cebu are also observed to bear eggs in November, December, and January. While examining a bobo panirikinia December 18 the writer again came across clusters of eggs very similar to those seen in Tuburan attached to seaweeds fastened to the sides of the bobo. From June to as late as September a large quantity of flying fish fingerlings, locally called *aliponghoc*, are caught mixed with the commercial catch.

ILLUSTRATIONS

Plate 1

Fig. 1. The drivers (abugan) coming close to the net with some of the men (marked X) swimming.
2. The barotos that were used by the drivers tied to the banca.
3. The scare line (bahan) being pulled on the banca.

Plate 2

Fig. 1. A typical tumuran.
2. The drivers coming home from the fishing ground.
3. The banca with the fishermen.

Plate 3

Fig. 1. The pamarong̃oy being carried to shore for drying.
2. The pamarong̃oy being spread on the drying yard.
3. The pamarong̃oy spread to dry.

Plate 4

Fig. 1. Retail fish vendors counting the fish contained in a sack.
2. Making tinapan.

PLATE 1.

PLATE 2.

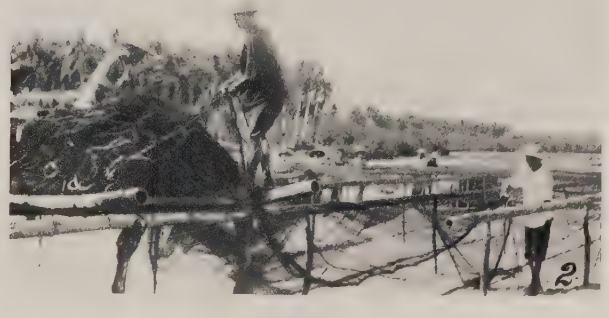

PLATE 3.

PLATE 4.

TUNA FISHERY AND LONG-LINE FISHING IN DAVAO GULF, PHILIPPINES

By CLARO MARTIN

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SEVEN PLATES AND TWO TEXT FIGURES

The possibilities of the tuna fishery of Davao Gulf have long been known to a few old resident Japanese fishermen, one of whom possesses a good knowledge of the tuna fishing grounds and the source of herring for bait in southern Mindanao as far as Zamboanga Province. In 1929 an enterprising American who saw conditions in the locality went to San Diego, California, to induce tuna packers there to finance a tuna canning plant in the town of Malita, Davao Province; however, nothing has been heard of this man since. In 1934 the Philippine Packing Corporation by means of the expensive modern fishing boat "Defender" made a survey of the Gulf as a possible source of tuna for their plant at Bogo, Misamis Oriental Province. In the same year the "Shonan Maru," the experimental fishing boat of the Formosa Government Fishery Experimental Station, touched the port at Davao in its survey of the tuna fisheries of the Celebes Sea. Information obtained from the technical men in the boat by the Japanese fishermen opened the eyes of the latter to the potentialities of the fishery. The exploitation of the fishery, however, did not begin until December, 1936, with the operation of the launch of Davao Fishery, Incorporated. The attention of other Japanese fishermen was drawn to the new fishery, and now several launches are operating.

Since the fishery is new in the locality, and the fishing methods employed are also new in the Philippines, both are described in the present paper.

SPECIES TAKEN

There are two principal commercial species of tuna caught in Davao Gulf. The skipjack, locally called *tuliñgan* (*Katsuwonus pelamis*), is the most abundant of the three, and therefore may be regarded as the most important. It is caught by pole and line. The other species is the yellowfin, or *bareles* (*Neo-*

thunnus macropterus). The yellowfin caught in Davao Gulf has the second dorsal and anal much elongated. This variety, according to Kishinouye,[1] is known in Japan as *itoshibi*, and is a variety of the true yellowfin. Jordan and Evermann,[2] however, regarded this variety as a new and distinct species and named it *Neothunnus itoshibi*. The yellowfins are caught both by pole and line, and by long line. One species of bonito (*Euthynnus yaito*) is also caught in good quantities, in fish corrals and by large beach seines.

While long-line fishing is principally intended for the yellowfins, spearfish, sailfish, large mackerels, and sharks are also caught, and comprise the by-product of the fishery. The spearfish (*Tetrapterus* sp.) and the sailfish (*Istiophorus* sp.) have not been definitely identified to the species. Two distinct species of mackerels (*Cybium commerson* and *Acanthocybium solandri*) are sometimes caught. Two species of sharks of the genus *Carcharinus* are often caught.

FISHING SEASON

Davao Gulf is within latitudes below the typhoon zone and is not much affected by the change of the monsoons. The period from July to October, however, is considered unfavorable for fishing, although all the tuna fishing motorboats have been operating continuously during those months, and the activities of the tuna fishermen are not stopped unless the gulf is disturbed by choppy seas caused by unusually strong winds.

The record of catch of the motorboat "Nena" shows that this boat has been in continuous operation from December, 1936, to December, 1937. From a peak of 14,513 kilograms in June the amount of catch has fallen to 8,976 in July, 7,966 in August, and 5,453 in September; and recovered a little in October with 8,501 kilograms. Poor fishing most often is caused by failure to catch herring for bait. During the period from July to October herring are quite scarce in the vicinity of Davao. The same record also shows that there are much more small yellowfins caught mixed with the striped tunas in March and April than in any other month. Big yellowfins were also being caught continuously since February by long-line outfits.

[1] Contributions to the comparative study of the so-called scomberoid fishes. Journ. Coll. Agric. (3) 8 (1923) 293–475.

[2] A review of the giant mackerel-like fishes, tunnies, spearfishes and swordfishes. Occ. Papers Calif. Ac. Sci. (12) (1926) 5–72.

As the fishery is still in its infancy and the data are very meager, it seems premature to draw conclusions as to the season for tuna fishing.

FISHING GROUNDS

Definite portions of the Gulf of Davao have been found by the tuna fishermen to yield good catches of each of the two principal species of tunas found in the Gulf (text fig. 1). The skipjack is found in the waters north, south, and west of Samal Island. Although large schools of skipjack are frequently seen north of Samal Island, the large tuna outfits, using pole and line with live baits, do not operate in this portion of the Gulf. It is claimed by these fishermen that it is hard to chum the fish in this part, due to comparatively heavy traffic there which tends to make the fish watchful and wild. This place, however, is the main fishing ground of the troll-line fishermen from Samal Island. The western half of the Gulf from south of Talicod and Samal Islands to north of Malita constitutes the main fishing ground for skipjack. Small immature yellowfins from 3 kilograms to about 15 kilograms in weight are also caught in the same fishing ground with the skipjack.

The main fishing ground for yellowfins is the eastern two-thirds of the entrance to the Gulf from off Monserrat to within twenty miles south of Cape San Agustin. The western part of the entrance of the Gulf did not prove to be a good fishing ground for yellowfin. It was found that more yellowfin could be caught further outside the Gulf, but on account of the size of the craft the operation is limited to within a radius of twenty miles from Port San Agustin.

Together with the yellowfins, spearfish, sailfish, and several species of sharks are caught in the same fishing ground.

THE TUNA FISHING MOTORBOATS

There are two kinds of fishing motorboats used in tuna fishing in Davao Gulf. The motorboats used in pole-and-line fishing for striped tuna are provided on the foredeck with compartments used for live well. The bottom of these compartments is provided with holes for the entrance and circulation of sea water when the fish are in. The live well is also used for stowing the catch when fishing is over. Fitted along the larboard side of the boat from bow to stern is a 1-inch pipe line. This is connected to a pump placed on the top of the engine house

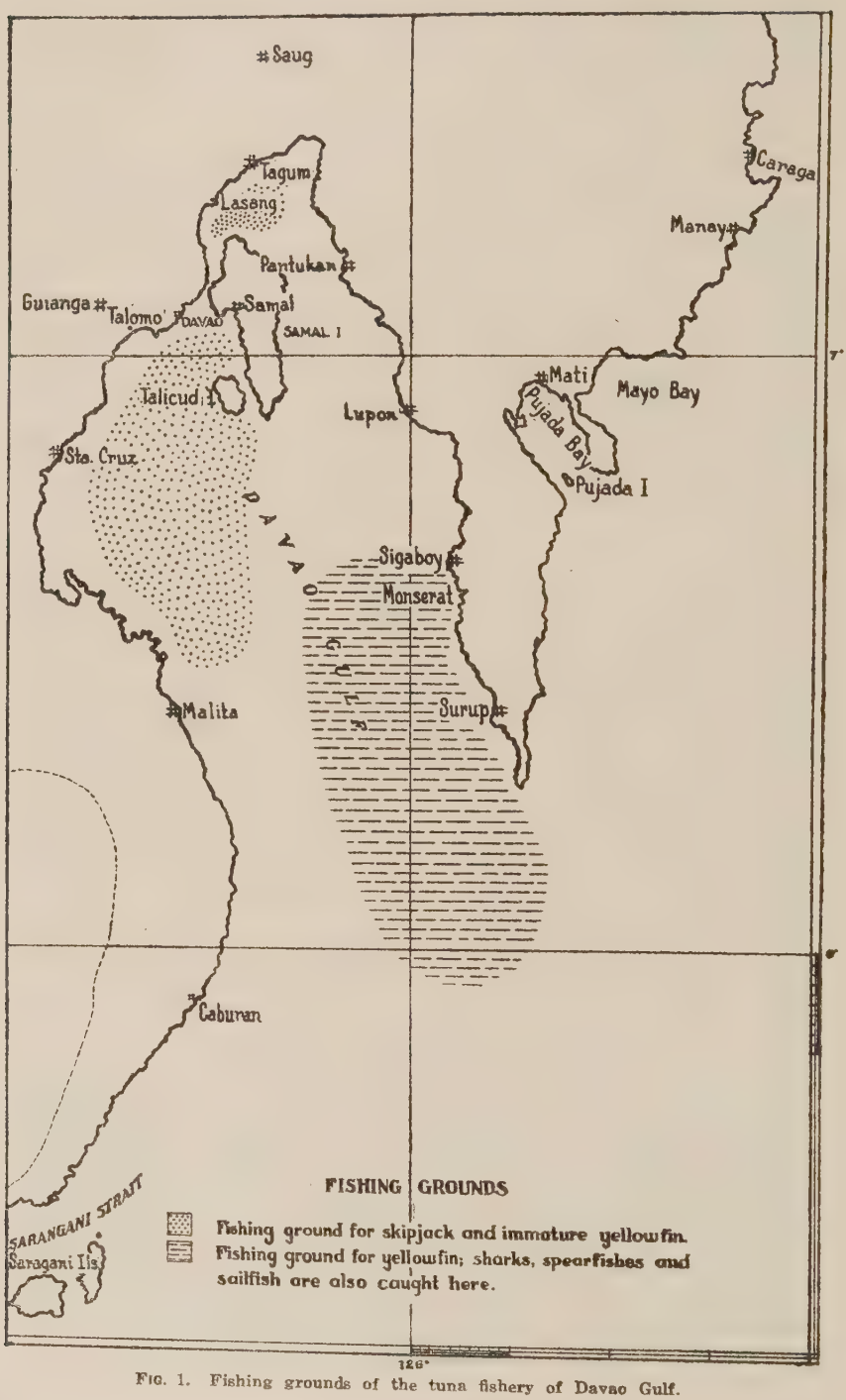


FIG. 1. Fishing grounds of the tuna fishery of Davao Gulf.

and geared to the main engine. The pipe line is tapped at several places at the bow and stern portions and fitted with spraying fixtures. The pump and the tapped pipe line serve to create the water spray, water being pumped from the live well during actual fishing.

The crew of a pole and line fishing motorboat is composed of one *patron* (or boat master), one engineer, and 12 to 18 men. This number is, however, dependent upon the tonnage of the boat.

The long-line tuna motorboats are all small craft of below three tons gross, powered by at least a 20-H. P. engine. The foredeck is clear and provided with an insulated hold. The insulation consists of sawdust and tar paper. In this hold is deposited the crushed ice that serves as refrigeration for the bait as well as for the catch. In all the newly constructed boats the baskets for long-line fishing are placed on the foredeck; the rest of the space, covered with tarpaulin in the evening, furnishes sleeping space for the fishermen. The crew usually consists of six men, one acting as engineer and the rest fishermen.

All motorboats except one, the "Lamidan," are Japanese-owned. Most of the fishermen are Japanese, although a few are Filipinos, natives of Bohol. The Japanese fishermen are paid on partition basis. After all running expenses and maintenance costs have been paid, 60 per cent of the net income goes to the fishermen and 40 per cent to the owner of the outfit. The Filipino fishermen are paid from 12 pesos [3] to 18 pesos a month with free food.

TABLE 1.—*Tonnage, measurements, and methods of fishing of various fishing motorboats.*

Boat.	Gross tons.	Net tons.	Length.	Width.	Depth.	Method of fishing.
			m.	*m.*	*m.*	
"Nena"	23.03	12.68	14.60	2.90	1.90	Pole and line.
"Meding"	2.78	1.89	8.00	1.82	0.90	Long line.
"Mabine"	2.94	2.00	8.53	1.96	0.83	Pole and line.
"Mayon"	2.97	2.02	7.92	1.95	0.92	Long line.
"Mucho"	1.47	1.00	10.03	1.95	0.83	Long line.
"Lamidan"	4.41	3.00	10.31	2.23	1.10	Pole and line.[a]
"Bareles"	2.97	2.02	9.75	1.80	0.80	Long line.
"Padada"	2.96	2.02	10.38	2.32	0.58	Pole and line.
"Talomo"	2.28	1.55	10.70	2.00	0.94	Long line.

[a] Changed to long-line method in November.

[3] One peso equals 50 cents United States currency.

FISHING METHODS

Troll line.—Troll-line fishing for striped tunas is engaged in by a number of fishermen from Samal Island, Bunawan, and Talomo, using small one-man craft especially built for speed, having sharp bottoms and outriggers. The fishermen follow the school of fish in their boats and drag their baited hooks and lines in the midst of the school (sometimes to the annoyance of the pole-and-line fishermen).

Fish corral.—Stray and mostly small, immature striped tunas and bonitos are also caught in shallow-water fish corrals. A large deep-water fish corral specially for catching tuna has just recently been constructed at Talomo by a professional Batangas corral fisherman; it is about 12 fathoms deep, and the style is *kinorona.*[4]

Seines.—The bonitos and small striped tunas that come close to shore are also caught in large beach seines having a length of more than 100 meters. The Davao Fishery, Incorporated, is contemplating to use a purse seine for catching bonito.

Pole and line.—Pole-and-line fishing for both striped tunas and small yellowfins is carried on by means of launches ranging from about 3 to 23 gross tons.

In this method of fishing each of the fishermen—numbering from twelve to fifteen—is provided with a pole 3.5 meters long. To the distal end of the pole are fastened two lines about three meters long. These two lines each carry different barbless hooks. The shank of one of the hooks is provided with solid tin molded in the shape of a small fish, dressed with white feathers in the hind portion. The other hook is a simple angular one. A piece of gunny sack is rolled around the portion about 1 foot above the lower end of the pole to provide a good hold and for sticking the hooks when not in use.

The launch leaves the shore before dawn. The first thing done is the securing of live herring to be used as bait; these are bought from the herring fishermen who keep them in large floating dip nets for the pole-and-line fishermen. The live herring are received and kept in the live well of the launch.

As soon as the bait is obtained, when the sun is just rising, the launch starts cruising to locate the schools of fish in the fishing ground. About two hundred meters from the sighted school one man starts to throw bait, one or two herring at a

[4] Same as *linati*, described by Talavera and Montalban. Philip. Journ. Sci. 48 (1932) 459.

time, to attract the fish, increasing the amount, though sparingly, as the fish are attracted. The boat is stopped but the engine is kept on to run the pump; the water spray is turned on and the fishermen already at their posts begin fishing using first the feathered hook. The fall of the water spray serves to simulate the commotion of a school of small fish, and also serves as a screen to hide the activity of the fishermen from the fish. As soon as the fish are noticed not to bite the feathered hook anymore, the fishermen change to the plain hook baited with fresh herring. When a large school is encountered, a ton of fish can be landed in a half hour. Fishing goes on as long as there is bait and as long as the school of fish does not leave. When fishing is over the launch is turned homeward. The fish are washed of blood and slime on deck and stowed in the live well; the holes of the latter are plugged at this time.

Long line.—Before leaving for the fishing ground for long-line fishing, the hold of the motorboat is filled with crushed ice. The bait, which may be small mackerel (*Rastrelliger chysozonus*) or small milkfish (*Chanos chanos*) contained in wooden slat trays are stowed in the ice hold.

Strong, stout, cotton twine, $\frac{1}{4}$ inch in diameter, is used in long-line fishing. The twine is dyed with *tañgal* (*Ceriops tagal*) bark. Each fishing motorboat carries 10 to 14 baskets of long line (text fig. 2). The long line in one basket varies in length in different boats from 475 to 915 meters. Being a drift line, it is supported by float lines, commonly four in number, 18 to 25 meters long and fastened to either a cylindrical wooden float or a spherical glass buoy. The float lines generally divide the long line into three sections. Usually three gangings, each ranging in length from about 45 to about 62 meters, are suspended from each section. The lower end of the ganging to which the hook is fastened is stranded (19 strands) steel wire 2 to 3 meters long. Two kinds of hooks are used, one rounded, the other ellipsoidal. Flags to determine the location of the line and for identification are also indispensable accessories of the long line. Extra hooks and line, butchering implements, and a small harpoon are also taken along in the boat. The small harpoon is used in case the catch is a big fish, a shark, or a spearfish, which are difficult to land.

During the entire period of the trip, which takes from three to five days, the boats stay always at sea. As there is no anchorage on the shores close to the fishing grounds, the fisher-

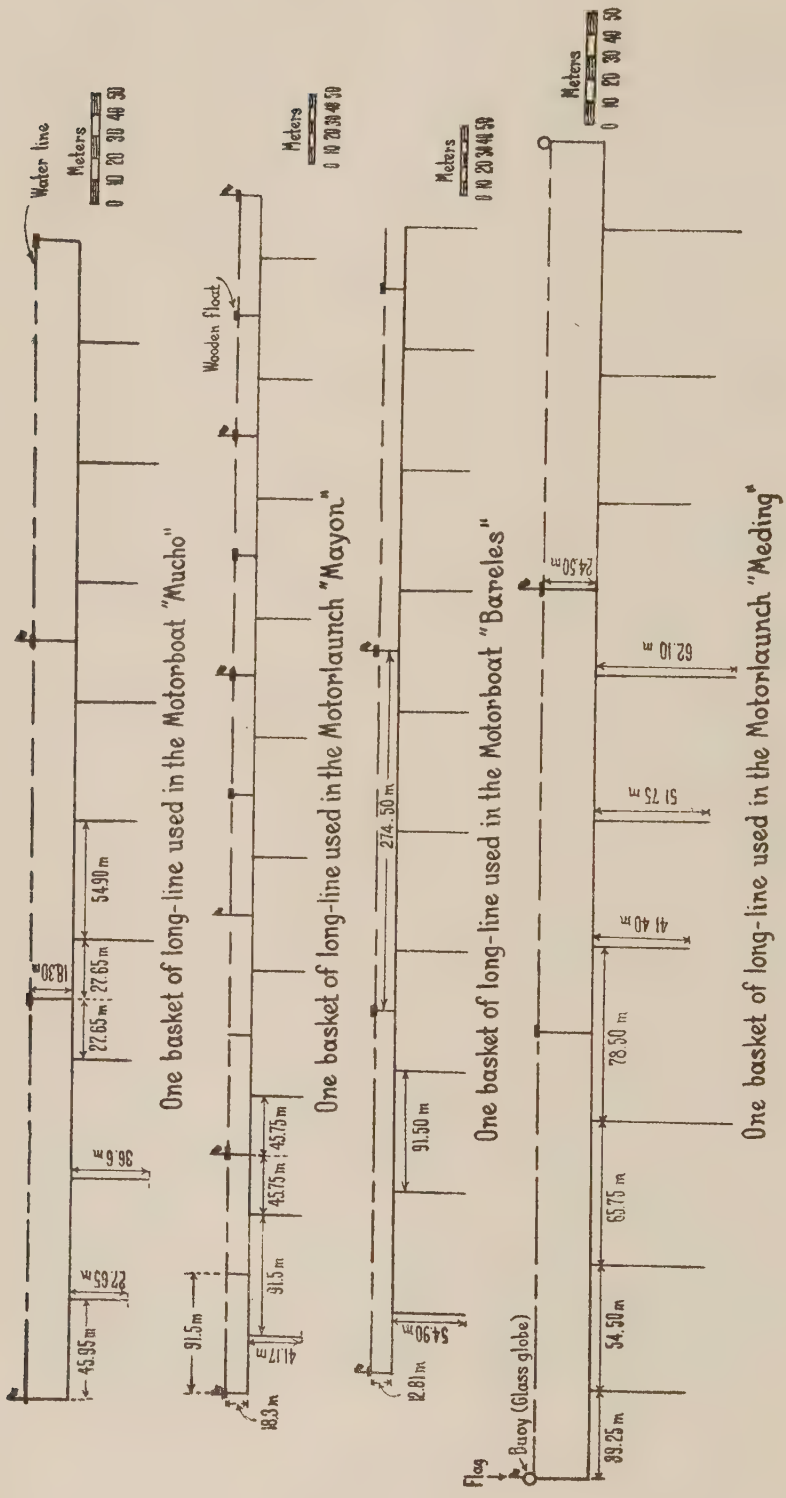


FIG. 2. Arrangement of long lines.

men pass the night with the boat drifting some distance from the shore.

The fishermen start the boat early to the fishing ground. At sunrise setting of the long line begins. By this time the boat is about seven to eight miles off the nearest coast, or even farther. The line is set east to west or east to southwest and across the flow of the current at the entrance of the Gulf.

The setting of the line is done on the stern. The engine is run at half speed. A flag and a glass buoy are fastened to one end of the main line of the first basket and thrown overboard. The line is paid out as the boat runs. . A fisherman takes charge of paying out the main line. One fisherman takes charge of baiting the hooks of the branch line. Another takes charge of fastening the floats and flags to the float line. The branch line carrying the hook, dressed with the bait, is thrown on the left side and the float line on the right, both at the proper time. Not all floats or buoys are provided with flags. If the first buoy carries a flag, the one following is without, and so on, alternating one with and one without. The line of one basket is joined end to end to that of another until all the lines are set in a continuous long line of several miles. The setting of the long line takes about one and a half hours. After this operation the boat is steered windward more than a mile from the set line. The line is gone over for the catch two times in the morning, and once in the afternoon, and then hauled in for coiling in the baskets at 3 P. M. or 4 P. M. The hauling in of the line consumes four and a half hours at most.

In going over the line for the catch the boat is steered from one end of the long line to another. A float or buoy submerged or partly submerged due to the weight or the pull of the catch is a sign for the boat to stop. The particular float or buoy is pulled to bring the main line on deck. The end of the line which pulls heavily suggests the direction in which the catch is to be found. The hauling of the line and the landing of the catch is done on the bow.

HANDLING AND MARKETING

Fish caught by the pole-and-line outfits are not iced on the boat, as the fishing ground is not very far from Davao, the home port of all tuna fishing motorboats and the distributing center of fish in the northwestern part of the Gulf. On arrival at the landing the boat is met by retailers. Fish that are not disposed of are kept iced in large ice boxes with three to five

compartments. The ice boxes are made by the fishermen themselves. A square opening wide enough for a man to pass through is cut on top of each compartment. The insulation is of sawdust and tarred paper. Galvanized sheet iron is used as the lining inside. Fish can be kept five days at most in these boxes, although the fish are disposed of before this time is reached, as they soften on the fourth or fifth day and constitute a loss.

In long-line fishing large-sized fish, weighing from 30 up to more than 200 kilograms, constitute the catch. The yellowfins and spearfish are butchered and cleaned soon after landing. The fins are cut off, the head severed, and the belly eviscerated. The head, although not sold, is saved for the table of the fishermen. It is parted in two, its gills removed, and washed clean. The butchered fish and heads soon after cleaning are stowed in the insulated hold, laid side by side, and packed well with crushed ice. Not infrequently yellowfins half-eaten up by sharks are landed. In this case the fish is not thrown away and what parts are utilizable are saved. Usually sharks are caught primarily for the fins. Sometimes, however, the meat is cut into narrow strips which are salted. These salted strips of shark meat are placed in sacks, which, however, are not stowed in the hold as the strong fishy odor of the shark meat might impair the quality of the other fish in the hold.

Upon return to port the fish are transferred to the cold storage warehouse of the Davao Ice Plant Company, whence they are disposed of to the retail vendors.

Skipjacks are sold to the vendors in the round and by weight. Some vendors sell their fish in the market stalls, others peddle them on their shoulders. The peddler always carries a bolo for cutting the fish into slices, and a balance for weighing the slices. Ordinarily skipjacks are bought by the vendors at from 15 to 20 centavos a kilogram and retailed at from 20 to 30 centavos. Yellowfin tuna and spearfish are bought by the vendors at from 30 to 35 centavos per kilogram, and retailed at from 50 to 60 centavos a kilogram.

REMARKS

Nowhere in the Philippines except in Zamboanga Province, where there is a small tuna canning plant, is the tuna fishery as important as in Davao Gulf, due to the fact that all the catch is disposed of in the fresh-fish markets. Approximately 80 per cent of the skipjacks, yellowfins, and spearfish landed in Davao are consumed by Japanese residents.

ILLUSTRATIONS

PLATE 1

FIG. 1. The "Lamidan," a pole-and-line fishing motorboat which after one month operation was converted into a long-line outfit.
2. The "Nena," a 23-ton pole-and-line fishing motorboat.
3. The two live wells of the "Nena." The depth of the live wells may be appreciated by noting the man inside.

PLATE 2

FIG. 1. A fisherman throwing live sardine bait to keep the school of skipjack closer alongside of the "Nena."
2. Fishermen in action at the bow of the "Nena."
3. Fishermen in action at the stern of the same boat.

PLATE 3

FIG. 1. The catch at the bow of the "Nena."
2. The catch at the stern of the same boat.
3. The catch of the "Nena" being taken at the landing by retail vendors.

PLATE 4

FIG. 1. The "Meding," a long-line fishing motorboat all set for the trip to the fishing ground.
2. Baskets of long line on the deck of the "Meding"; note also the spherical glass buoys.
3. Fishermen of the "Meding," setting the long line early in the morning.

PLATE 5

FIG. 1. A yellowfin tuna just landed.
2. Pulling a ganging or branch line with a catch.
3. A spearfish being butchered.

PLATE 6

FIG. 1. Hauling in the long line in the afternoon.
2. Spherical glass buoy used in the "Meding."
3. Flag and the spherical glass buoy marking one end of the long line.

PLATE 7

FIG. 1. Two kinds of hooks used in pole-and-line fishing.
2. Twine used in long-line fishing.
3. Two kinds of hooks used in long-line fishing; note the seizing (stranded steel) wire.

TEXT FIGURES

FIG. 1. Fishing grounds of the tuna fishery of Davao Gulf.
2. Arrangement of long lines.

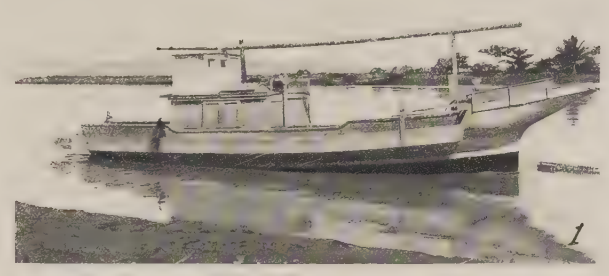


PLATE 1.

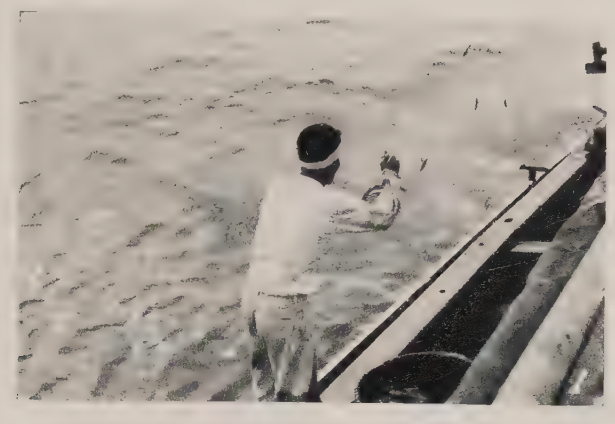


PLATE 2.

PLATE 3.

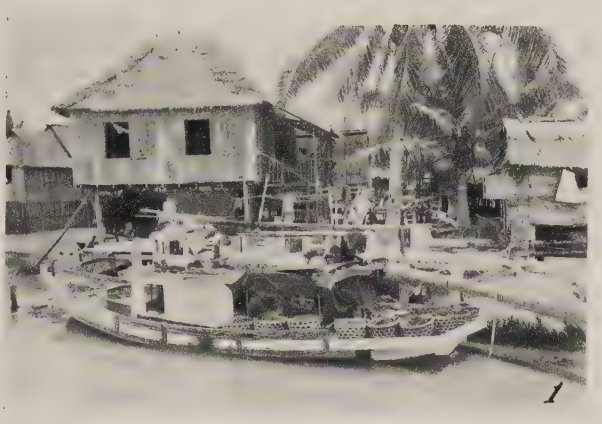
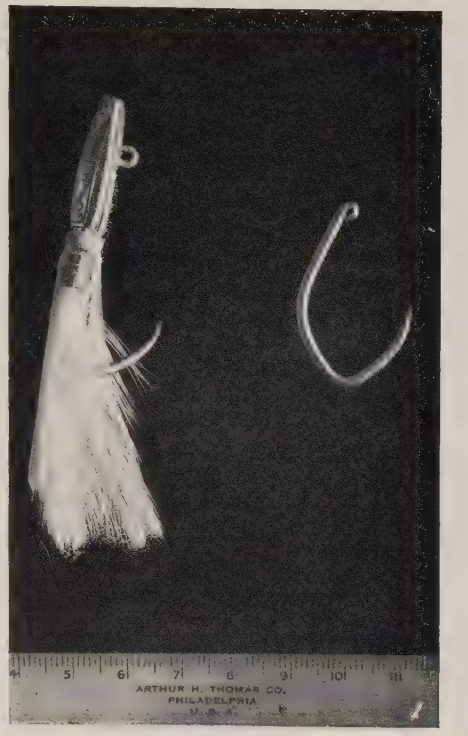


PLATE 4.

PLATE 5.

PLATE 6.



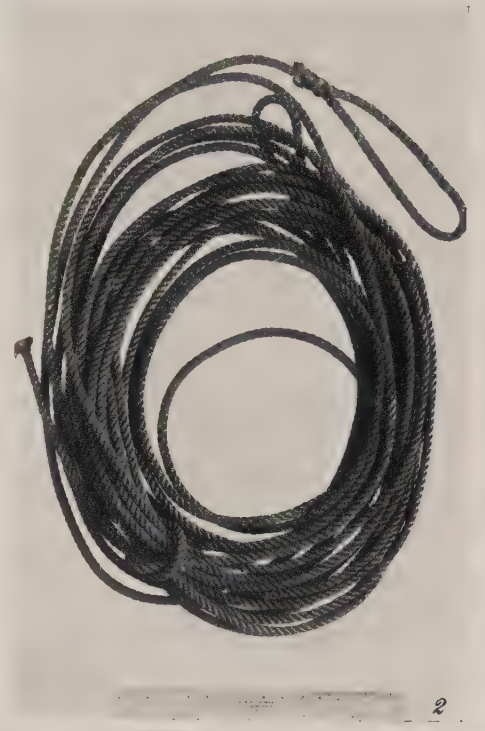


PLATE 7.

A NEW SPECIES OF PALÆMON FROM NORTHERN LUZON

By GUILLERMO J. BLANCO

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ONE PLATE

In this paper is given the description of a new macrurus crustacean, *Palæmon luzonensis* sp. nov. This commercial shrimp, known in Iloko as *aramang,* is taken in large quantities at the mouth of Cagayan River from August to January. A small drag seine (*bannuar*) is used in catching the aramang with the aid of a small boat (*balasiang*).

The shrimps are usually dried in the sun along the beach, but during the rainy season they are generally salted and fermented into *bagoong.* The value of dried and salted products from the aramang fishery of Cagayan is estimated at 10,000 to 15,000 pesos [1] annually. Dried aramang is packed in boxes or sacks and shipped to Manila and the Ilocos provinces, mostly by Chinese but also by a few Filipino dealers. From September to December, 1937, about 720 cavanes, or 54,000 liters [2] of aramang, valued at 4,320 pesos, were shipped to Manila and the Ilocos provinces. So far there is no record of the value of dried aramang and bagoong made of aramang sold in the interior towns of Cagayan Valley.

Genus PALÆMON Fabricius

Rostrum well developed, laterally compressed, toothed above and below. Carapace smooth, furnished with antennal and branchiostegal spines. Pterigostomian spine wanting. Mandible with three-jointed palp.

PALÆMON LUZONENSIS sp. nov. Plate 1, figs. 1 to 11.

Carapace provided with an antennal and branchiostegal spine; supraorbital and hepatic spine absent; pterigostomian angle rounded, without spine. Rostrum long, thin, distinctly curved upwards, laterally compressed; distal tip reaching beyond end

[1] One peso equals 50 cents United States currency.

[2] One cavan equals 25 gantas or 75 liters.

of antennal scale; dorsal border above orbital notch armed with six to seven teeth; four to five teeth on carapace, two on declining ridge, one near tip; ventral border with four widely spaced teeth (Plate 1, fig. 1). Eyes slender, two times as long as wide; breadth of cornea 2.5 times dorsal length of eye; ocellus well marked (Plate 1, fig. 2). Basal segment of first antennular peduncle with well-developed terminal spine (Plate 1, fig. 3). Outer antennular flagellum bifid, shorter branch unsegmented. Flagella of first antennæ 1.75 times as long as entire length of shrimp. Antennal scale (Plate 1, fig. 4), three times as long as wide, not tapering; outer margin straight, terminating in an acute spine which does not reach beyond end of lamella. Mandible with strong molar and incisor process and 3-jointed palp (Plate 1, fig. 5). Maxillule cross-shaped, distal margin of outer lacinia with hairs; endopodite with a thumblike apical process terminating in long setæ (Plate 1, fig. 6). Third maxilliped usually with five articulations and reaching beyond merus of first leg; terminal joint with long hair process (Plate 1, fig. 8). First pair of peræopods chelate (Plate 1, fig. 9), reaching beyond antennal scale; chela, carpus, and merus unequal in length. Fingers 1.5 times as long as palm, with tufts of hairs. Second pair of peræopods chelate (Plate 1, fig. 10), robust, two times as long as first, reaching beyond rostrum by length of chela. Fingers curved at tips, with straight cutting edges provided with several minute teeth. Fingers 1.75 times as long as palm; carpus 2.66 in merus, no spines on their distal border.

Body slightly compressed laterally, dorsally rounded.

Third, fourth, and fifth legs similar in form and proportion; fifth longer than preceding two; dactylus terminating in hairlike structure. Pleopods long and foliaceous. Sixth abdominal somite narrow, width two times in length. Telson (Plate 1, fig. 11) tapering, without spines on dorsal side; terminal border with two spines of equal length; in between with a pair of setæ.

Type locality.—Aparri, Cagayan Province, Luzon. Specimens were caught in bannuar drag net.

Live specimens transparent yellowish, with pink eggs in female. Preserved specimens in alcohol, yellowish.

Several male and female specimens collected from Aparri, Cagayan, September 10, 1937, range from 44 mm to 80 mm from tip of rostrum to tip of telson.

Palæmon luzonensis can be distinguished from other known described species of *Palæmon* by the character of its thin upwardly turned rostrum, its slight laterally compressed body, its

tapering telson without dorsal spines, and the character of its weak third, fourth, and fifth walking legs. Males and females similar. Morphological dimorphism apparently lacking.

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ILLUSTRATION

[Drawings by the author.]

PLATE 1. PALÆMON LUZONENSIS SP. NOV.

1, Male, lateral view, × 4; *2*, eye, lateral view, × 60; *3*, antennule with portion of flagella, ventral view, × 60; *4*, antennal scale, × 60; *5*, mandible with palp, × 60; *6*, maxillule, × 60; *7*, maxilla, × 60; *8*, terminal joint of third maxilliped, × 60; *9*, chela of first peræopod, × 100; *10*, chela of second peræopod, × 60; *11*, apex of telson, × 100.

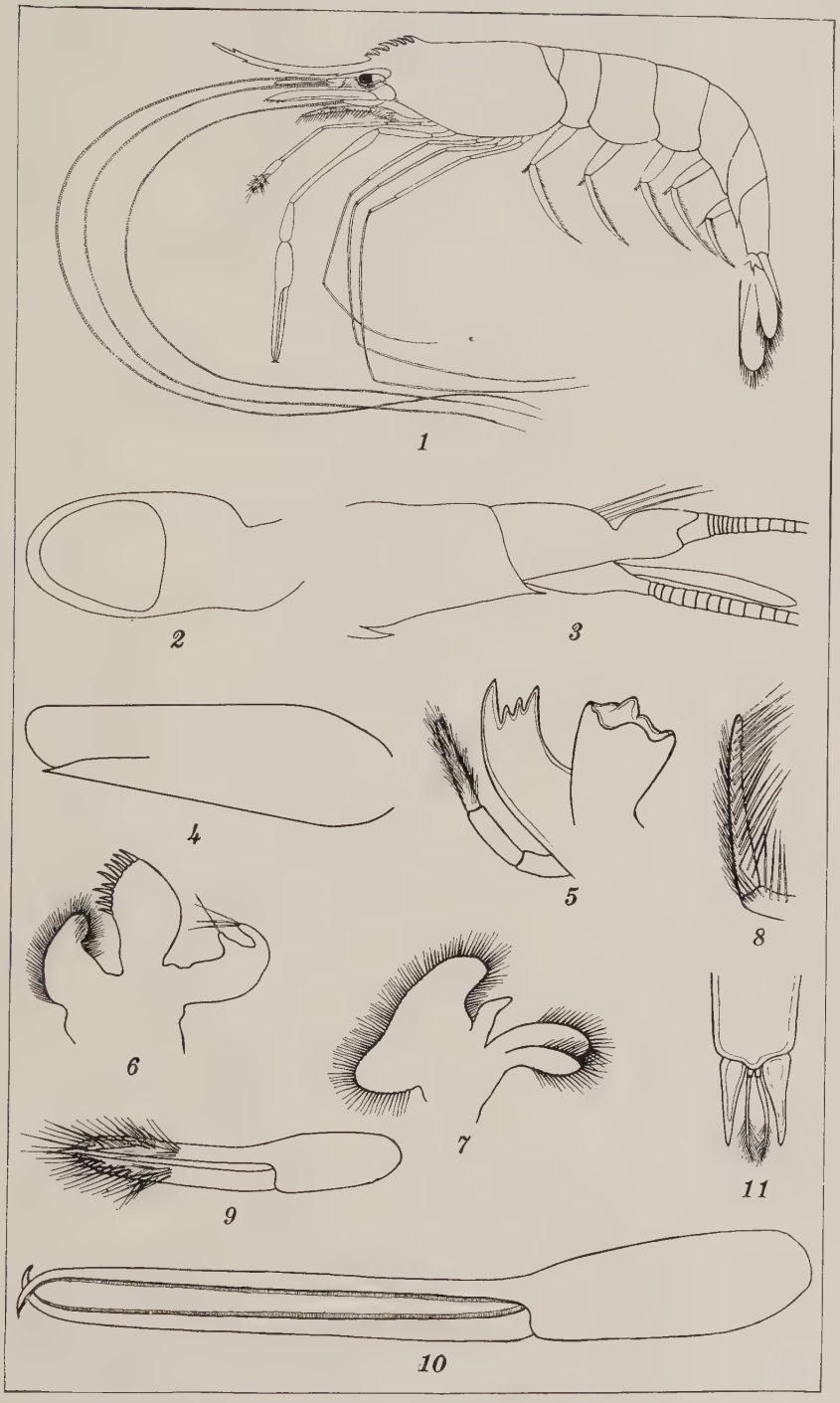

PLATE 1. PALÆMON LUZONENSIS SP. NOV.

A REVIEW OF PHILIPPINE HOLOCENTRIDÆ

By JOSE R. MONTILLA

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FIVE PLATES

This paper contains a review of species of the family Holocentridæ known to inhabit Philippine waters. The material used is in the collection of the Fish and Game Administration, Bureau of Science, Manila.

The soldier fishes (Holocentridæ) are shore fishes generally inhabiting rocky banks in tropical seas. They are active, carnivorous, and quarrelsome fishes, and take the hook readily. Hence they are considered game fishes.

The flesh of the Holocentridæ is firm; their scales are very hard, large, and with very rough edges. Their coloration is almost always brilliant, characteristic of fishes of coral reefs. These fish are caught in large numbers and are valued as food.

Body oblong, or rather elevated and compressed. Head moderate; eye large, lateral; mouth moderate, cleft more or less oblique, extending to the sides of the muzzle; both jaws, vomer, palatines, and sometimes ectopterygoid with bands of small teeth; bones of head grooved or with strong ridges, ending in short or long spines and forming a posterior serration, especially in opercular series. Dorsal with ten to eleven spines; anal four, third usually very long; ventrals thoracic, with a spine and 5 to 8 soft rays; caudal forked. Scales moderate, ctenoid, very strong, absent on head. Pyloric appendages numerous or moderate in number.

Key to the Philippine genera of the Holocentridæ.

a^1. A long spine at edge of preoperculum..... *Holocentrus.*
a^2. No long spine at edge of preoperculum..... *Myripristis.*

Genus HOLOCENTRUS Gronow, 1763

Oblong or more or less elongate, compressed, back more or less arched. Branchiostegals eight. Eyes large. Mouth moderate. Jaws of equal length, or lower slightly longer; snout of moderate length. Bands of small teeth on premaxillaries, vomer,

palatines, ectopterygoids, and lower jaw. Opercles and suborbitals serrated; opercle with two spines, generally a large spine at angle of preopercle. Posterior and inferior border of preoperculum, operculum, and suboperculum with a row of parallel spines, less developed on interoperculum. Orbitals serrated. Preorbital with a row of generally large spines along its lower border and often similar spines along a median ridge. Dorsal beginning a short distance behind head, separated by a deep notch into a longer anterior spiny part and a shorter posterior soft part. Dorsal spines commonly eleven, strong, depressible in a groove; anal opposite to soft dorsal, with four spines, third longest, enormously developed, provided at its back with a groove to fit last, slenderer, and shorter spine; caudal forked; pectorals with a weak short spine. Ventral fins with a slender spine and seven soft rays. Scales ctenoid, of moderate size. No scales on skull, which is provided with divergent bony ridges. Lateral line continuous. Pyloric appendages numerous. In life always brilliant red, with lines or stripes of black, white, or golden. Fins often with black and white markings.

Habitat.—Tropical seas. On rocky banks near the shore.

Key to the Philippine species of Holocentrus.

a^1. Last dorsal spine longer than penultimate. Lower jaw more prominent.
  b^1. Membrane of spinous dorsal never black, sometimes a black spot between first spines. Anal IV 7 to 8..... *H. sammara.*
  b^2. Membrane of spinous dorsal black with a white band. Anal IV 8 to 10 ..... *H. opercularis.*
a^2. Last dorsal spine shortest. Jaws equal or upper jaw slightly prominent.
  b^1. Two and a half rows of scales between spinous dorsal and lateral line.
    c^1. Membrane of spinous dorsal blackish, crossed by a white band. *H. diadema.*
    c^2. Membrane of spinous dorsal not black or without crossed band.
      d^1. Lateral line 50 or 51. Nasalia not rounded. A silvery patch below posterior part of spinous dorsal..... *H. bleekeri.*
      d^2. Nasalia rounded in front. Eight or nine rows of scales on preoperculum.
        e^1. Lateral line 42 to 44. Nasalia rounded in front, without spines. *H. lacteo-guttatus.*
        e^2. Nasalia ending with deviated spines. Lateral line 33 to 41.
          f^1. Snout much shorter than eye. No silvery patch on superior part of caudal peduncle.
            g^1. Nasal opening without spines..... *H. ruber.*
            g^2. Nasal opening with spines..... *H. cornutus.*
          f^2. Snout more pointed, equal to eye or nearly equal. Oftentimes a silvery patch on superior part of caudal peduncle. Nasal opening with spines.

g [1]. Lateral line 34 to 37. Membrane of spinous dorsal scarcely incised ..... *H. violaceous.*

g [2]. Lateral line 41. Membrane of spinous dorsal incised. *H. caudimaculatus.*

b [2]. Four rows of scales between spinous dorsal and lateral line. Lateral line 43 or 44 ..... *H. spinifer.*

HOLOCENTRUS SAMMARA (Forskål). Plate 1, fig. 1.

Sciæna sammara FORSKÅL, Descript. Anim. (1775) 48, 49.

Labrus angulosus LACÉPÈDE, Hist. Nat. Poiss. 3 (1802) 430.

Holocentrus samara RÜPPELL, Atl. Reise N. Afrika (1826–1831) 85.

Holocentrus sammara CUVIER and VALENCIENNES, Hist. Nat. Poiss. 3 (1829) 216; BLEEKER, Journ. Ind. Arch. 2 (1848) 636; Nat. Tijdschr. Ned. Ind. 3 (1852) 555; GÜNTHER, Cat. Fish. Brit. Mus. 1 (1859) 46; BLEEKER, Ned. Tijdschr. Dierk. 4 (1873) 213; GÜNTHER, Südsee Fische 1 (1873–1875) 100; DAY, Fishes of India 4° (1878–1888) 173; SAUVAGE, Poiss. Madagas. (1891) 31; WEBER and DE BEAUFORT, Fish. Indo-Austr. Arch. 5 (1929) 233–235.

Holocentrus sammara JORDAN and SEALE, Bull. U. S. Bur. Fish. 25 [(1905) 1906] 227.

Holocentrus fuscostriatus SEALE, Occ. Papers B. P. Bishop Mus. Hawaii 1 (1901) 69.

Holocentrus microstomus FOWLER, Proc. Acad. Nat. Sci. Phila. 53 pt. 2 (1901) 325 (nec. Günther).

Flammeo sammara JENKINS, Bull. U. S. Fish. Comm. 22 [(1902) 1904] 440; JORDAN and EVERMANN, Bull. U. S. Fish. Comm. 23 [(1908) 1905] 155.

Dorsal X, I, 12; anal IV, 8; pectoral 14; ventral I, 7; lateral line 40 to 42; transverse line 12.

Elongate, dorsal profile sloping down in a gently curved line from dorsal to snout. Height of body 3 to 3.3; head 2.7 to 3; eye 2.5 to 3 in head; snout 3.5 to 4 in head. In young, eye slightly less than snout. Interorbital space 1.3 to 1.5 of eye. Maxillary reaching or not reaching to below anterior half of eye; nasal opening rounded or obtusely pointed in front without spine; lower jaw prominent; nasal opening without spines; teeth villiform. Preorbital with a row of subequal numerous spines; postorbital narrow, serrated along hind border; limbs of preopercle serrated in entire extent, length of preopercular spine equal to about one third diameter of eye. External edges of all opercles more or less serrated; opercle with two spines, upper as large as preopercular, lower rather smaller. Preorbital denticulation strong; suborbital serrated. Predorsal scales 6 or 7. Second and third dorsal spines longest, about equal to fourth spine but shorter than snout and eye together. After fourth spine preceding spines decreasing in size, second to last shortest; last dorsal spine slightly longer than preceding spine, about equal to half diameter of eye; second dorsal highest an-

teriorly, rather higher than highest dorsal spine. Pectoral nearly equal to head excluding snout. Ventrals and pectorals subequal, as long as eye and snout. Ventral spine somewhat longer than postorbital part of head, reaching halfway to the anal. Least height of caudal peduncle 1.1 to 2.2 in its length. Caudal forked, lobes rounded. Third anal spine strongest and longest, equalling from 3.5 to 4 in length. Scales six to seven rows between occiput and base of dorsal fin, seven along preopercle.

Body with or without longitudinal violet bands, which may be composed of spots. Black spot may be present on either cheek. Usually a black spot between first four dorsal spines, sometimes a light mark at bases and at tips of first ten spines. Anterior edge of soft dorsal and anal, also usually upper and lower edge of caudal, violet.

Distribution.—Red Sea, east coast of Africa, seas of India to Malay Archipelago and beyond.

The above description is based on specimen No. 12212, 115 mm, collected from Tambo, Ambil Island, Mindoro Province, August 30, 1925.

LUZON, Ilocos Norte Province, Burgos, No. 14773, 67 mm, October 29, 1936: Manila, No. 27424, 142 mm, 1911. MINDORO, Mindoro Province, Puerto Galera, No. 7195, 131 mm, 1912; Tambo, Ambil Island, No. 12212, 113 mm, August 30, 1925. PALAWAN, Palawan Province, Carigara, No. 12612, 81 mm, No. 27426, 35 mm, November 7, 1925. MINDANAO, Sulu Province, Bungau, No. 11504, 121 mm, No. 27423, 125 mm, August 27, 1924; No. 13652, 113 mm, No. 27428, 104 mm, No. 27430, 120 mm, No. 27429, 121 mm, No. 16356, 134 mm, No. 12612, 97 mm, April 15, 1926; No. 11109, 102 mm, June 18, 1921; Tubigan Island, No. 27427, 153 mm, No. 13512, 131 mm, January to March, 1926; Sitankai, No. 16353, 78 mm, June 17, 1921: Zamboanga Province, No. 27422, 144 mm, No. 10699, 136 mm, May, 1921.

GUAM, No. 7081, 42 mm, No. 7082, 45 mm.

HOLOCENTRUS OPERCULARIS Cuv. & Val. Plate 1, fig. 2.

Holocentrum operculare CUVIER and VALENCIENNES, Hist. Nat. Poiss. 7 (1831) 377; QUOY and GAIMARD, Voy. Astrol. Poiss. 3 (1834) 676; BLEEKER, Nat. Tijdschr. Ned. Ind. 2 (1851) 233; Ned. Tijdschr. Dierk. 4 (1873) 211; GÜNTHER, Cat. Brit. Mus. 1 (1859) 47; Fische der Südsee 1 (1873–1875) 100, pl. 66, fig. *a*; SEALE, Occ. Papers B. P. Bishop Mus. Hawaii 1 (1901) 68; WEBER and DE BEAUFORT, Fish. Indo-Austr. Arch. (1929) 232–234.

Holocentrus opercularis JORDAN and SEALE, Bull. U. S. Bur. Fish. 25 [(1905) 1906] 227.

Dorsal X, I, 13; anal IV, 9; pectoral 14; ventral 1.7; lateral line 38 to 40; transverse line 12.

Body elongate, dorsal profile practically straight from dorsal spine to snout. Height 3.5 in length without caudal. Head 2.9 in length. Eye 3.3, about equal snout. Maxillary reaching to below middle half of eye. Nasal opening round, without spines. Lower jaw more prominent. Lower border of preorbital with spines, directed backwards. Postorbital bone narrow, serrated. All parts of opercular and preopercular bone serrated along posterior borders. Operculum with two spines, upper spine longest. Preopercular spine broad and long, not reaching to gill opening. Seven transverse rows of scales on preoperculum. Origin of dorsal separated by 7 scales from occiput. Fourth dorsal spine longest, second, third, and fifth of practically same length; tenth spine shorter than eleventh, which is shorter than half diameter of eye. Membrane between spines incised. First anal spine small, third broad, strong and long, almost equal to head without snout, with a deep furrow behind to fit fourth spine, which is slender and equal to postorbital part of head. Ventrals and pectorals equal to head without snout. Lobes of caudal equal, 5.6 long.

Preserved specimen in alcohol silvery, each scale brownish with a silvery border. Fins yellowish pink. Membrane of spinous dorsal black, with sawlike subbasal longitudinal band and a white upper margin, biggest immediately behind each spine.

Distribution.—Tahiti, New Ireland, Samoa, Guam, Philippine Islands.

The above description is based on specimen No. 721, 160 mm, collected from Puerto Galera, Mindoro Province.

MINDORO, Mindoro Province, Puerto Galera, No. 7228, 170 mm, March, 1912.

HOLOCENTRUS LACTEO-GUTTATUS (C. V.) M. Weber. Plate 1, fig. 3.

Holocentrum lacteo-guttatum CUVIER and VALENCIENNES, Hist. Nat. Poiss. 3 (1829) 160; WEBER, Fische Siboga-Exped. (1913) 183; WEBER and DE BEAUFORT, Fish. Indo-Austr. Arch. 5 (1929) 240–242.

Holocentrum argenteum CUVIER and VALENCIENNES, Hist. Nat. Poiss. 7 (1831) 377; QUOY and GAIMARD, Voy. Astrol. Poiss. 3 (1834) 677.

Holocentrum punctatissimum BLEEKER, Nat. Tijds. Ned. Ind. 4 (1853) 248; Ned. Tijds. Dierk. 4 (1873) 215; JORDAN and EVERMANN, Bull. U. S. Fish. Comm. 23 [(1903) 1905] 162; JORDAN and SEALE, Bull. U. S. Bur. Fish. 25 [(1905) 1906] 224.

Holocentrum diploxiphus GÜNTHER, Fische der Südsee 1 (1873–1875) 97.

Holocentrum gladispinis FOWLER, Proc. Acad. Nat. Sci. Phila. 56 (1904) 225.

Holocentrus lacteoguttatus JORDAN and SEALE, Bull. U. S. Bur. Fish. 25 [(1905) 1906] 225; JORDAN and RICHARDSON, Bull. U. S. Bur. Fish. (1908) 247.

Dorsal XI, 13; anal IV, 9; pectoral 15; ventral 1.7; lateral line 44; transverse line 12.

Body oblong. Height of body 2.9 to 3 in length without caudal. Head 3 in length, compressed, upper profile more convex than lower; snout 1.75 to eye, short, convex, upper jaw projecting a little; eye large, 2.5 to 2.8 in head; interorbital space 1.4 to eye. Mouth rather small; maxillary small, slipping below narrow preorbital; teeth minute, pointed, in band in jaws, on palatines, and a small patch on vomer. Nostrils close to front rim of orbit, anterior inconspicuous but posterior part with large cavity. Interorbital space broad, slightly concave medially. Lower border of preorbital with a strong spine anteriorly, directed backwards and followed by a series of smaller spines. Postorbital bone narrow, serrated. Preopercle armed below at its angle with a broad daggerlike spine equal to half diameter of eye. Two superior spines of operculum enlarged, equal to or shorter than preopercular spine. Gill opening extending forward opposite middle of orbit.

Scales somewhat small, imbricated. Scales at base of spinous dorsal forming a sheath, each scale ending in a backwardly directed spine. Two and a half rows of scales between spinous dorsal and lateral line. Eight transverse rows of scales on preoperculum. Origin of dorsal separated by 8 scales from occiput. Spinous dorsal inserted over origin of pectoral, fourth spine longest, next two nearly subequal. First spine about equal ninth, eleventh shortest, equal to half eye. Membrane between dorsal spines deeply incised. First anal spine very small, third longest, as long as pectoral. Pectoral rather long, equal to head without snout, slender, upper rays longest. Ventral spine slender, a little over two-thirds length of fin. Least height of caudal peduncle 1.6 in its length.

Specimen in alcohol faded brassy brown, with more or less developed lighter longitudinal bands, corresponding with rows of scales. Above lateral line through longitudinal pale whitish bands along each series of scales. Below, seven bands, those just below lateral line broadest. Spinous dorsal with a small white blotch behind each spine.

Distribution.—Java, Celebes, Ceram, New Guinea, Philippines.

The above description is based on specimen No. 12339, 88 mm, September 22, 1925. Collected from Sialat point, Catanduanes, Albay, the only specimen in our collection.

GUAM, No. 10993, 87 mm, August, 1912.

HOLOCENTRUS RUBER (Forskål). Plate 2, fig. 1.

Sciæna rubra FORSKÅL, Descript. Anim. (1775) 48.

Perca rubra BLOCH, Schneider, Syst. Ichth. (1801) 90.

Holocentrus orientale CUVIER and VALENCIENNES, Hist. Nat. Poiss. 3 (1829) 147–150.

Holocentrum marginatum CUVIER and VALENCIENNES, Hist. Nat. Poiss. 3 (1829) 161.

Holocentrum laticeps CUVIER and VALENCIENNES, Hist. Nat. Poiss. 3 (1829) 157; 7 (1831) 376.

Holocentrum rubrum GÜNTHER, Cat. Brit. Mus. 1 (1859) 35; PLAYFAIR, Fish. Zanzibar (1866) 52; BLEEKER, Ned. Tijdschr. Dierk. 4 (1873) 224; GÜNTHER, Fische der Südsee 1 (1873–1875) 96; DAY, Fishes of India 4° (1878–1888) 172; MACLEAY, Descr. Cat. Austr. Fish. 1 (1881) 149; SAUVAGE, Poiss. Madagas. (1891) 35; WEBER and DE BEAUFORT, Fish. Indo-Austr. Arch. 5 (1929) 244–246.

Holocentrus alboruber JORDAN and FOWLER, Proc. U. S. Nat. Mus. 26 (1902) 15.

Holocentrus albo-ruber FOWLER, Proc. Acad. Nat. Sci. Phila. 56 (1904) 235.

Holocentrus praslin JORDAN & SEALE, Bull. U. S. Bur. Fish. 25 [(1905) 1906] 225; JORDAN and STARKS, Proc. U. S. Nat. Mus. 32 (1907) 494.

Holocentrus ruber JORDAN and SEALE, Proc. Dav. Acad. Sci. 10 [(1905) 1907] 5; JORDAN and RICHARDSON, Bull. U. S. Bur. Fish. (1908) 248; JORDAN and STARKS, Ann. Carnegie Mus. 11 (1917) 447; FOWLER and BEAN, Proc. U. S. Nat. Mus. 62 (1922) 18.

Dorsal XI, 12 to 13; anal IV, 9 or 10; pectoral 14; ventral I, 7; lateral line 33 to 36; transverse line 9 to 9.5.

Body oblong; head blunt, its upper profile curved and rather abruptly descending from occiput to snout; height of body 2.5 to 2.9. Head 2.8 to 3; eye large, 2.5 to 2.6 in head, interspace between eyes one-fifth length of head and about twice as long as snout; jaws nearly equal, upper jaw scarcely projecting; bony ridges bordering groove; maxillary reaching not quite to below middle of eye; nasal opening without spines. Lower border of preorbital with a series of irregular blunt spines, preorbital ridge with smaller spines directed outwards, first somewhat longer. Operculum with two strong prominent spines, upper longer and stronger than lower. Preopercular spine less than eye. Preoperculum with six or seven rows of scales, about

six between occiput and dorsal. Third and fourth dorsal spines longest, last shortest; soft dorsal fin rather higher than spinous dorsal. Membrane between dorsal spines rather deeply incised. Third anal spine as long as head without snout; ventrals longer than pectorals, ventral spine equal to snout and eye, rather longer than pectorals. Least height of caudal peduncle, 1.3 to 1.5 in its length. Scales scarcely striated.

Red, with eight whitish longitudinal bands; outer edges of caudal blackish; ventrals whitish. Upper part of membrane between dorsal spines blackish, as well as that between third and fourth anal spines and first soft ray. A longitudinal darkish streak on edge of ventral rays and on upper and lower lobe of caudal.

Distribution.—East coast of Africa, Red Sea, coasts of India and Ceylon, to the Philippines and Japan, north and west coasts of Australia, eastward to Samoa.

The above description is based on specimen No. 1753, 125 mm, collected from Cagayan, Oriental Misamis Province, Mindanao, September 12, 1907.

LUZON, Pangasinan Province, Alaminos, No. 9673, 115 mm, 1921: Zambales Province, Iba, No. 9740, 143 mm, December, 1921: Cavite Province, Monja Island, No. 9767, 165 mm, April 23, 1922: Batangas Province, Nasugbu, Barrio Papaya, No. 13292, 155 mm, January 13, 1926: Tayabas Province, Polillo, No. 16036, 145 mm, March 28, 1928. MINDORO, Mindoro Province, Calapan, No. 9353, 115 mm, January, 1923. PALAWAN, Palawan Province, Culion, No. 10275, 145 mm, No. 27420, 136 mm, October 1, 1922. PANAY, Antique Province, Guimaras, No. 9924, 172 mm, June 4, 1922. CEBU, Cebu Province, Cebu, No. 9410, 82 mm, December, 1908. MINDANAO, No. 4308, 178 mm, June 3, 1908. Oriental Misamis Province, Cagayan, No. 1573, 126 mm, September 12, 1907: Zamboanga Province, Zamboanga, No. 2811, 180 mm, April 8, 1908: Sulu Province, Jolo market, No. 16268, 150 mm, January 30, 1930.

HONGKONG, No. 6459, 120 mm, No. 6396, 167 mm, August, 1910.

HOLOCENTRUS CORNUTUS Bleeker. Plate 2, fig. 2.

Holocentrum cornutum BLEEKER, Nat. Tijdschr. Ned. Ind. 5 (1853) 240; Ned. Tijdschr. Dierk. 4 (1873) 222; WEBER, Fische Siboga-Exped. (1913) 182; WEBER and DE BEAUFORT, Fish. Indo-Austr. Arch. 5 (1929) 243, 244.

Holocentrum melanospilos BLEEKER, Negende bijdrage Visch-fauna van Amboina, Act. Soc. Scient. Indo-Neerl. 3 (1858) 2.
Holocentrum melanospilus BLEEKER, Ned. Tijds. Dierk. 4 (1873) 226.
Holocentrus cornutus EVERMANN and SEALE, Bull. U. S. Bur. Fish. 24 (1906) 60.

Dorsal XI, 13; anal IV, 9; pectoral 12 or 13; ventral I, 7; lateral line 33 to 36; transverse line 10.

Body oblong, head blunt, its upper profile curved and rather abruptly descending from occiput to snout. Depth 2.8 to 3 in length. Head 3; eye large, 2.3 to 2.6 in head, about double length of snout; interorbital space about 1.5 in eye; jaws equal in front; maxillary reaching to below middle of eye; anterior nasal end and posterior part of nasal opening spiny. Lower border of preorbital with a series of irregular blunt spines, preorbital ridge with a large blunt spine in front. Opercular bones strongly denticulated. Two strong spines in upper part of operculum, upper longer and stronger than lower. Preopercular spine about equal eye. Preoperculum with six to seven transverse rows of scales, 6 or 7 scales between occiput and dorsal. Third and fourth dorsal spine longest, last shortest. Membrane between dorsal spines somewhat deeply incised. Third anal spine about length of head without snout; pectorals shorter than ventrals; ventral about equal head without snout. Ventral spine less than snout and eye. Least height of caudal peduncle 1.6 to 2 in its length. Scales firm, large, strongly ctenoid.

Alcoholic specimens light or dark brown, with longitudinal silvery bands along rows of scales; a dark blotch at base of caudal and on soft dorsal and anal present or absent; membranes between dorsal spines partly blackish, as also that between second and third anal spines and first soft ray of anal. Outer margins of caudal dark.

The above description is based on specimen No. 14067, 118 mm, collected from Sibutu Island, Sulu Province, April 27, 1926.

LUZON, Sorsogon Province, Bulan, No. 3928, 132 mm, 1904. MINDORO, Mindoro Province, Calapan, No. 12333, 138 mm, January, 1924; No. 14192, 132 mm, 1926; Puerto Galera, No. 7194, 117 mm, No. 7210, 115 mm, 1912. ROMBLON, Romblon Province, Romblon, No. 10469, 129 mm, August 1, 1921. NEGROS, Negros Oriental Province, Siquijor Island, No. 13484, 170 mm, March 10, 1926. CEBU, Cebu Province, Bantayan Island, No. 5741, 128 mm, May 1909. MINDANAO, Davao Province, Ti-

funod River, No. 10700, 102 mm, May 28, 1921: Sulu Province, Lumbian Island, November 10, 1927; Sibutu Island, No. 27417, 66 mm, No. 27418, 118 mm, April 27, 1926; Sibuud, Lapak, No. 15657, 88 mm, No. 27414, 94 mm, November 8, 1927; Bungao Island, No. 11364, 118 mm, July 15, 1924; Sitankai, No. 10696, 98 mm, No. 27413, 102 mm, June 17, 1921.

HOLOCENTRUS VIOLACEUS Bleeker. Plate 2, fig. 3.

Holocentrus violaceum BLEEKER, Nat. Tijdschr. Ned. Ind. 5 (1853) 335; GÜNTHER, Cat. Brit. Mus. 1 (1859) 43; BLEEKER, Ned. Tijdschr. Dierk. 4 (1873) 221.

Holocentrus violaceus JORDAN and SEALE, Bull. U. S. Bur. Fish. 25 [(1905) 1906] 223.

Dorsal XI, 14 or 15; anal IV, 9; pectoral 13; ventral I, 7; lateral line 34 to 38; transverse line 10.5.

Body oblong, dorsal profile sloping in a gentle convex curve to snout; height 2.5 to 2.6. Head 2.6 to 3. Eye 3.3; length of snout not much less than diameter of eye; jaws nearly equal in front; maxillary reaching to below anterior half of eye; nasal opening at anterior part with spines, posterior part with 3 spines. Preorbital with a large spine in front, directed downwards, followed by several smaller spines pointing in same direction. Postorbital serrated along its hind border. Opercular bones strongly serrated with two flat spines, lower spine smaller. Preopercular spine long, slender, about equal to diameter of eyes. Preoperculum with seven transverse rows of scales, seven scales between occiput and origin of dorsal. Third, fourth, and fifth dorsal spines longest, last shortest; first anal spine small, third longest, about 1.75 of head; ventrals practically equal to pectorals, which are equal to head without snout; ventral spine longer than eye, equal to part of head without snout and eye. Least height of caudal peduncle 1.3 to 1.5 in its length.

Alcohol specimens dark purplish brown, each scale with a broad silvery subterminal longitudinal band; upper end of operculum with a black blotch; upper side of caudal peduncle with a silvery patch immediately behind dorsal. Fins hyaline, spinous dorsal dusky.

Distribution.—New Guinea, North Australia, Fiji Islands, Samoa, Philippines.

The above description is based on specimen No. 7175, 134 mm, collected from Puerto Galera, Mindoro Province, March to May, 1912.

MINDORO, Mindoro Province, Puerto Galera, No. 7206, 155 mm, March to May, 1912. MINDANAO, Davao Province, Samal

Island, No. 3884, 117 mm, May 2, 1908. PANAY, Iloilo Province, Iloilo, No. 14432, 132 mm, June or July, 1923.

HOLOCENTRUS CAUDIMACULATUS Rüppell. Plate 3, fig. 1.

Holocentrus spinifer RÜPPELL, Atlas Reise Nördl. Afrika, Fische (1828) 86, pl. 23, fig. 1.

Holocentrum spiniferum CUVIER and VALENCIENNES, Hist. Nat. Poiss. 3 (1829) 206; 7 (1831) 347.

Holocentrum caudimaculatum RÜPPELL, Atlas Reise Nördl. Afrika, Fische (1828) 97; GÜNTHER, Cat. Brit. Mus. 1 (1859) 41; KNER, Fische Novara-Exped. (1865–1867) 8; PLAYFAIR, Proc. Zoöl. Soc. London (1867) 855; BLEEKER, Ned. Tijdschr. Dierk. 4 (1873) 219; GÜNTHER, Fische der Südsee 1 (1873–1875) 95; DAY, Fishes of India 4° (1878–1888) 172; WEBER and DE BEAUFORT, Fish. Indo-Austr. Arch. 5 (1929) 247–249.

Holocentrus caudimaculatus JORDAN and SEALE, Bull. U. S. Bur. Fish. 25 [1905 (1906)] 223.

Dorsal XI, 14; anal IV, 9; pectoral 14; ventral 1.7; lateral line 41 or 42; transverse line 12.

Body oblong, dorsal profile slightly arched; height 2.5. Head 2.6 to 2.8; eyes 3, longer than snout; interorbital space 1.75 in diameter of eye; maxillary reaching to below middle of eye; bony ridges bordering groove for peduncle of premaxillaries ending in a blunt bifid spine in front; front margin of nasal opening with one or more spines in old specimens; jaws equal. Preorbital serrated, anteriorly with a large blunt spine pointing downward and followed by small spines directed backward. Postorbital serrated. Opercular bones serrated, upper opercular spine longest; preopercular spine as long as or longer than orbit. Preoperculum with seven transverse rows of scales. Shoulder bone serrated. Intranasal spines 2. Eight scales between occiput and base of dorsal. Teeth villiform. Fourth dorsal spine longest, equal to about 2.3 of height of body, but shorter than soft dorsal. Dorsal interspinous membrane rather deeply emarginate. Third anal spine longest and strongest, longer than fourth dorsal spine and equalling about 1.3 of height of body; ventrals about equal to pectorals; ventral spine about equal to fourth dorsal spine, shorter than eye and snout. Least height of caudal peduncle 1.5 in its length. Caudal forked.

Preserved specimens in alcohol brownish, a conspicuous silvery patch on upper part of free portion of tail just behind end of soft dorsal fin; a reddish brown band along base of dorsal and anal.

Distribution.—Red Sea, Seas of India, and the Malay Archipelago.

The above description is based on specimen No. 12152, 131 mm, collected from North Ubian, Sulu Province.

MINDANAO, Sulu Province, Jolo Island, No. 2351, 132 mm, February, 1908; Lumbian Island, No. 15694, 130 mm, November 10, 1927.

HOLOCENTRUS DIADEMA Lacépède. Plate 3, fig. 2.

Holocentrus diadema LACÉPÈDE, Hist. Nat. Poiss. 5 (1803) 372–374; RÜPPELL, Atlas Reise N. Afrika, Fische (1826–1831) 84; CUVIER and VALENCIENNES, Hist. Nat. Poiss. 3 (1829) 213; BLEEKER, Nat. Tijdschr. Ned. Ind. 3 (1852) 259; GÜNTHER, Cat. Brit. Mus. 1 (1859) 42; Fische der Südsee 1 (1873–1875) 97; DAY, Fishes of India 4° (1878–1888) 171; SAUVAGE, Poiss. Madagas. (1891) 33; SEALE, Occ. Papers B. P. Bishop Mus. Hawaii 1 (1901) 68; JORDAN and EVERMANN, Bull. U. S. Fish. Comm. 23 [(1903) 1905] 150; WEBER, Siboga-Exp. Fische (1913) 180; WEBER and DE BEAUFORT, Fish. Indo-Austr. Arch. 5 (1929) 238–240.

Dorsal XI, 13 or 14; anal IV, 9; pectoral 14; ventral I, 7; lateral line 46 to 48; transverse line 12.

Body oblong, dorsal profile from snout to dorsal with slight curve; height of body 2.2 to 2.5. Head 3 to 3.4; eye 2.6 to 2.8, about 1.5 of snout; interorbital space 1.5 of eye; maxilla reaching to below anterior third of orbit. Opercles, preorbital, and suborbitals denticulated, as is also posterior half of upper edge of orbit. Lower edge of preorbital serrated and with a strong blunt spinate projection directed downwards and forwards. Operculum with two prominent spines, upper spine stronger, nearly equal in size to preoperculum. Preopercular spine stout, equal to snout. Preoperculum with eight transverse series of scales, 7 or 8 scales between origin of dorsal and occiput. Fourth to sixth dorsal spines longest, equal to about half height of body, interspinous membrane deeply cleft; two dorsal fins about same height. Third anal spine as long as head without snout; ventral longer than pectorals, longer than head without snout; ventral spine about equal to snout and eye. Least height of caudal peduncle 1.5 in its length.

Preserved specimens in alcohol reddish, with ten white bands along body, corresponding to longitudinal rows of scales. Membrane of spinous dorsal black; crossed by a white band from lower portion of first dorsal spine to sixth and by a similar band near upper margin from sixth to last dorsal spine. Membrane between third and fourth anal spines darkish.

The above description is based on specimen No. 13624, 98 mm, collected from Bungau Island, Sulu Province, April 17, 1926.

CATANDUANES, Albay Province, Sialot Point, No. 17278, 110 mm, September 22, 1925. MINDANAO, Sulu Province, Lumbian Island, No. 15612, 120 mm, No. 17271, 122 mm, No. 17272, 113 mm, No. 17273, 108 mm, No. 17274, 108 mm, No. 17275, 114 mm, No. 17276, 105 mm, November 10, 1927; Siasi Island, No. 27412, 80 mm, No. 16355, 88 mm, June 21, 1921; Bungau Island, No. 13624, 97 mm, No. 17269, 76 mm, No. 17270, 67 mm, April 17, 1926; Lubian Island, No. 15598, 69 mm, November 10, 1927; Bato, Tawitawi Island, No. 13648, 103 mm, April 5, 1926.

HOLOCENTRUS BLEEKERI M. Weber. Plate 3, fig. 3.

Holocentrum argenteum BLEEKER, Act. Soc. Sc. Ind. Neerl. 111 10* Bijdrage Vischfauna Amboina (1858) 1; Ned. Tijdschr. Dierk. 4 (1873) 208 (nec. C. V.).

Holocentrum bleekeri WEBER, Fische Siboga-Exped. 65 (1913) 181; WEBER and DE BEAUFORT, Fish. Indo-Austr. Arch. 5 (1929) 237, 238.

Dorsal XI, 13; anal IV, 9; pectoral 15; ventral I, 7; lateral line 50 or 51; transverse line 12.

Body oblong, dorsal profile ascending to about 22.5 degrees from snout to dorsal fin, thence descending nearly straight to end of spinous dorsal; height 3.3 to 3.5. Head 2.9 to 3 in length; eye large, diameter longer than snout; interorbital space 1.5 of eye; maxillary not reaching below middle of eye; nasal opening without spines; jaws equal. Lower border of preorbital with a series of irregular blunt spines, preorbital ridges with a large blunt spine in front and directed downward, followed by a few similar but much smaller spines. Postorbital finely serrated. Operculum strongly serrated along free border. Preopercular spine strong and moderately long, about one-half diameter of eye. Two enlarged spines on upper part of operculum. Preoperculum with eight transverse rows of scales, eight scales between occiput and dorsal. Fifth dorsal spine longest, about as long as eyes and snout together, last spine shortest. Membrane between dorsal spines deeply incised. First anal spine very small, third strongest and about as long as height of body; pectorals shorter than ventral; ventral spine equal tc or more than half length of head. Least height of caudal peduncle 2 in its length.

Alcoholic specimens reddish brown with silvery longitudinal bands along rows of scales; silvery band above lateral lines with a brighter silvery path below posterior half of spinous dorsal. Fins yellowish.

Distribution.—New Guinea, Pacific Islands, Philippines.

The above description is based on specimen No. 16357, 142 mm, collected from Manila.

HOLOCENTRUS SPINIFER (Forskål). Plate 4, fig. 1.

Sciæna spinifera FORSKÅL, Descript. Anim. (1775) 49.

Holocentrum leo CUVIER and VALENCIENNES, Hist. Nat. Poiss. 3 (1889) 153–155; BLEEKER, Nat. Tijdschr. Ned. Ind. 7 (1854) 355; SAUVAGE, Poiss. Madagas. (1891) 28.

Holocentrum spiniferum GÜNTHER, Cat. Brit. Mus. 1 (1859) 39; KNER, Fische Novara Exped. (1865–1867) 7; BLEEKER, Ned. Tijdschr. Dierk. 4 (1873) 205; GÜNTHER, Fische der Südsee 1 (1873–1875) 94; WEBER and DE BEAUFORT, Fish. Indo-Austr. Arch. 5 (1929) 235–237.

Holocentrum andamense DAY, Proc. Zoöl. Soc. (1870) 686; Fishes of India 4° (1878–1888) 172.

Holocentrus spinifer FOWLER, Proc. Acad. Nat. Sci. Phila. (1899) 483; JORDAN and EVERMANN, Bull. U. S. Fish. Comm. 23 [(1903) 1905] 161; JORDAN and SEALE, Bull. U. S. Bur. Fish. 25 [(1905) 1906] 223.

Dorsal XI, 15; anal IV, 10; pectoral 15; ventral I, 7; lateral line 43 or 44; transverse line 14.

Body oblong, dorsal profile running in a straight line from dorsal to snout, with a hump at nape. Head, 2.6 in length; eye 3.6 in head, about same as snout; interorbital space narrow, twice in eye and 7.5 to 8 in head; maxillary reaching below anterior of eye; lower jaw more prominent; opening without spines. Preorbital with several slender spines. Preopercular spine large and stout, reaching to branchial opening. Preoperculum with seven transverse rows of scales. Operculum with four flat spines, two upper spines smaller; opercular spines followed by numerous smaller spines, arranged in a parallel row. Origin of dorsal separated by about 9 scales from occiput. Second, third, and fourth dorsal spines longest, about same length as third anal spine; first and third spines slenderer than second and fourth; dorsal spines decreasing in size, last shortest, only one-third of eye. Soft dorsal fin about equal in height to spinous; first anal spine minute, third very stout, equal to eye and snout, with a deep furrow posteriorly to receive the fourth spine which is shorter and slenderer than third anal spine; ventrals about equal to pectorals which are equal to head without snout. Caudal forked, lobes pointed.

Rose-colored, with a deep-red spot behind eye, another deep-red spot above roof of pectoral, spinous dorsal deep red; other fins yellow.

Distribution.—Eastern coast of Africa through Indian Ocean to Pacific Ocean.

The above description is based on specimen No. 7107, 147 mm, collected from Puerto Galera, Mindoro Province, March to May, 1912. PALAWAN, Palawan Province, Cuyo Island, No. 15525, 265 mm, June 18, 1927.

GUAM, No. 7085, 110 mm, September, 1911.

Genus MYRIPRISTIS Cuvier, 1829

Oblong, back more or less arched. Caudal peduncle slender, caudal forked. Eyes generally large. Mouth moderate. Lower jaw more prominent. Villiform teeth in both jaws, on vomer and on palatine bones. Teeth of the outer series in upper jaw generally larger. Branchiostegals eight (exceptionally seven). Orbital and opercular bones serrated; operculum generally with a spine, preoperculum without spine. Dorsal beginning a short distance behind head, two dorsal fins scarcely united, first with ten to twelve spines, second with one spine and twelve or more soft rays. Dorsal spines depressible in a groove; ventrals with a long slender spine and seven rays; pectoral with a flexible spine and fourteen to sixteen soft rays. Caudal forked. Anal with four spines. Scales large, strongly ctenoid. No scales on skull. Lateral line continuous. In life generally bright red, with golden and silvery reflections or longitudinal bands.

Distribution.—Tropical seas of both hemispheres.

Key to the Philippine species of Myripristis.

a^1. Two patches of strong tubercular teeth on chin, two other patches on upper jaw. Lateral line 27 or 28..... *M. melanostictus.*

a^2. Two patches of tubercular teeth on chin and upper jaw not very prominent. Lateral line 28 to 40.

b^1. Lateral line 36 to 40. Snout 3 to 3.25 in eye; maxillary reaching below hind margin of pupil..... *M. pralinius.*

b^2. Lateral line 28 to 30. Snout 2.5 to 3 in eye.

c^1. Snout 2 to 2.5 in eye. About 3 round strong teeth on each side of upper jaw ..... *M. murdjan.*

c^2. Snout 2.5 to 3 in eye. Upper jaw with a few pointed teeth. *M. schultzei.*

MYRIPRISTIS MELANOSTICTUS Bleeker. Plate 4, fig. 2.

Myripristis hexagonus BLEEKER, Nat. Tijdschr. Ned. Ind. 3 (1852) 262; Enum. Spec. Piscium (1859) 3 (nec. C. & V.).

Myripristis melanostictus BLEEKER, Ned. Tijdschr. Dierk. 1 (1863) 237; 4 (1873) 187; WEBER and DE BEAUFORT, Fish. Indo-Austr. Arch. 5 (1929) 258, 259.

Myripristis botche KNER, Fische Novarra Exped. 1 (1865) 5, 6.

Myripristis macrolepis BLEEKER, Ned. Tijdschr. Dierk. 4 (1873) 195; EVERMANN and SEALE, Bull. U. S. Bur. Fish. 26 [(1906) 1907] 60; SNYDER, Proc. U. S. Nat. Mus. 42 (1912) 495; WEBER, Fische Siboga-Exped. (1913) 186.

Myripristis melanostigma BLEEKER, Atl. Ichth. 9 (1877) pl. 355, fig. 3 (errore).

Dorsal X, 14; anal IV, 12; pectoral I, 14; ventral I, 7; lateral line 27 or 28; transverse line 10.5.

Height 2.2 to 2.4. Head 2.6 to 2.9. Eye 2.2 to 2.3. Interorbital space about one-half of eye, 4.5 to 5 in head; maxillary reaching to below posterior edge of pupil of eye. Lower border of posterior edge of maxillary with a series of rounded teeth; teeth in upper jaw enlarged and rounded at tip, the rest less pointed and more granular; a strong rounded tooth on each side of symphysis of lower jaw, and another strong rounded tooth on each side of chin, below the one mentioned; tongue without teeth. Dorsal separated by 8 or 9 scales from occiput; third and fourth dorsal spines longest, more or less equal to diameter of eye; third anal spine longest and strongest; pectoral and ventral spines about equal, shorter than head without snout; ventral spine longer than pectoral spine, equal to diameter of eye. Least height of caudal peduncle more than half of eye. Caudal deeply forked.

Alcoholic specimens yellowish brown with golden reflections and with more or less distinct silvery broad longitudinal bands on the body, corresponding to the rows of scales.

Alcoholic specimens reddish with golden or silvery reflections. Fins yellowish.

Distribution.—Celebes, Japan, Philippines. The above description is based on specimen No. 1625, 115 mm, collected from Cagayan, Oriental Misamis Province, Mindanao, September 13, 1907.

MINDORO, Mindoro Province, Calapan, No. 1012, 141 mm, August 27, 1907. MINDANAO, Oriental Misamis Province, Cagayan, No. 1568, 91 mm, No. 1570, 105 mm, No. 1640, 94 mm, September 13, 1907; No. 1567, 101 mm, September 12, 1907: Sulu Province, Bungau Island, No. 13595, 62 mm, April 17, 1926.

MYRIPRISTIS MURDJAN (Forskål). Plate 4, fig. 3.

Sciæna murdjan FORSKÅL, Descript. Anim. (1775) 48.

Perca murdjan BLOCH and SCHNEIDER, Syst. Ichth. (1801) 85; LACÉPÈDE, Hist. Nat. Poiss. 4 (1802) 396, 418.

Myripristis murdjan RÜPPELL, Atlas Reise N. Afrika Fische (1826–1831) 86; CUVIER and VALENCIENNES, Hist. Nat. Poiss. 3 (1829)

177; BLEEKER, Nat. Tijdschr. Ned. Ind. 3 (1852) 109; GÜNTHER, Cat. Brit. Mus. 1 (1859) 21; KNER, Fische Novara Exped. (1865–1867) 4; BLEEKER, Ned. Tijdschr. Dierk. 4 (1873) 188; GÜNTHER, Fische der Südsee 2 (1873–1875) 92; DAY, Fishes of India 4° (1878–1888) 170; SAUVAGE, Poiss. Madagas. (1891) 20; SEALE, Occ. Papers B. P. Bishop. Mus. Hawaii 1 (1901) 67; JORDAN and EVERMANN, Bull. U. S. Fish. Comm. 23 [(1903) 1905] 152; JORDAN and SEALE, Bull. U. S. Bur. Fish. 25 [(1905) 1906] 220; Evermann and Seale, Bull. U. S. Bur. Fish. 26 [(1906) 1907] 60; JORDAN and RICHARDSON, Bull. U. S. Bur. Fish. 27 [(1907) 1908] 247; TANAKA, Fishes of Japan 4 (1911) 53; WEBER, Fische Siboga-Exped. (1913) 186; JORDAN and STARKS, Ann. Carnegie Mus. (3–7) 11 (1917) 447; WEBER and DE BEAUFORT, Fish. Indo-Austr. Arch. 5 (1929) 259–262.

Myripristis parvidens CUVIER and VALENCIENNES, Hist. Nat. Poiss. 3 (1829) 173; BLEEKER, Nat. Tijdschr. Ned. Ind. 3 (1852) 260; WEBER, Fische Siboga-Exped. (1913) 185.

Myripristis violaceus BLEEKER, Nat. Tijdschr. Ned. Ind. 2 (1851) 234; Ned. Tijdschr. Dierk. 4 (1873) 192.

Myripristis microphthalmus BLEEKER, Ned. Tijdschr. Dierk. 4 (1873) 191; JORDAN and SEALE, Bull. U. S. Bur. Fish. 25 [(1905) 1906] 220; EVERMANN and SEALE, Bull. U. S. Bur. Fish. 26 [(1906) 1907] 60; WEBER, Fische Siboga-Exped. (1913) 186.

Myripristis adustus BLEEKER, Ned. Tijdschr. Dierk. 4 (1873) 193; JORDAN and SEALE, Bull. U. S. Bur. Fish. 25 [(1905) 1906] 220.

Myripristis botche DAY, Fishes of India 4° (1878–1888) 169; Suppl. 788.

Dorsal X, I, 14; anal IV, 12; pectoral 15; ventral I, 7; lateral line 28 to 30; transverse line 10.

Height 2.2 to 2.6. Head 2.5 to 3. Eye 2.5. Interorbital space twice in eye; snout 3 in eye; lower jaw slightly longer, with a rough, nipplelike projection on either side of symphysis; maxillary reaching to below posterior border of eye with blunt denticulations on its front near its lower end; teeth villiform in jaws, an external row of widely separated teeth which are larger and rounded; tongue without teeth; undersurface of lower jaw furrowed by ten or twelve grooves; maxillæ, pre-, sub-, and interopercles also grooved. Preopercle serrated in its whole extent. Opercle with a short strong spine, denticulated above this spine and along the whole of its outer margin, serrated below. Shoulder scale serrated. Upper surface of head with four raised lines subdividing each branch terminating in a small spine. Origin of dorsal separated by 7 to 9 scales from occiput. Dorsal spines increasing in length to third, third of equal length as sixth; interspinous membrane rather deeply emarginate; third anal spine strong but generally not much longer than

fourth spine, equal to eye; pectorals longer than ventrals, a little less than head without snout; ventral spine equal to or longer than eye. Least height of caudal peduncle more than half diameter of eye. Caudal forked.

Alcoholic specimens yellowish brown; posterior membrane of operculum blackish; gill openings deep brownish black, axil of pectorals often black; a dark vertical band through eye, often confined to above pupil; dorsal, anal, and caudal fins with milky outer edges; a dark stripe present or absent at highest points of soft dorsal and anal fins, also at tip of caudal; seldom a dark mark along first dorsal; outer edge of ventral fins white.

Distribution.—Red Sea, east coast of Africa, Malay Archipelago, Philippines.

The above description is based on specimen No. 14066, 130 mm, collected from Sibutu Island, Sulu Province, April 27, 1926. BATANES, Batanes Province, Santo Domingo de Basco, No. 12539, 165 mm, No. 27463, 140 mm, November 3, 1935. LUZON, Zambales Province, Subic, No. 12013, 155 mm, February 20, 1920: Manila, No. 10979, 131 mm, No. 10981, 155 mm, No. 17277, 135 mm, No. 27444, 131 mm, 1911: Sorsogon Province, Bacon, No. 3227, 126 mm, No. 3723, 170 mm, 1904. MINDORO, Mindoro Province, Calapan, No. 15786, 80 mm, 1927; Puerto Galera, No. 7122, 122 mm, No. 7123, 112 mm, No. 7124, 133 mm, No. 7125, 145 mm, No. 7126, 134 mm, No. 7196, 118 mm, No. 7197, 118 mm, No. 7211, 120 mm, No. 7212, 115 mm, No. 7213, 105 mm, No. 7218, 115 mm, No. 7224, 130 mm, No. 7671, 133 mm, No. 7674, 103 mm, No. 9227, 135 mm, March to May, 1912. CEBU, Cebu Province, Bantayan, No. 57367, 95 mm, No. 5772, 80 mm, May, 1909. PALAWAN, Palawan Province, No. 12651, 38 mm, No. 27443, 51 mm, November, 1925. MINDANAO, Zamboanga Province, Zamboanga, No. 4173, 148 mm, May 26, 1908: No. 4248, 133 mm, 1908: Sulu Province Jolo, No. 2362, 93 mm, February, 1908; Mabajoc Point, No. 15661, 87 mm, No. 27480, 100 mm, No. 27481, 80 mm, No. 27482, 80 mm, No. 27483, 101 mm, No. 27484, 90 mm, No. 27485, 83 mm, No. 27486, 70 mm, No. 27487, 71 mm, No. 27488, 112 mm, No. 27489, 100 mm, No. 27490, 96 mm, November 10, 1927; Lubian Island, No. 15611, 130 mm, No. 15649, 130 mm, No. 15682, 85 mm, No. 27467, 95 mm, No. 27468, 102 mm, No. 27469, 98 mm, No. 27490, 112 mm, No. 27471, 117 mm, No. 27473, 118 mm, No. 27474, 90 mm, No. 27475, 108 mm, No. 27476, 86 mm, No. 27477, 90 mm, No. 27478, 112 mm, No. 27479, 122 mm, No.

27491, 124 mm, No. 27492, 114 mm, No. 27493, 112 mm, No. 27494, 130 mm, No. 27495, 106 mm, No. 27496, 113 mm, No. 27497, 116 mm, No. 27498, 125 mm, No. 27499, 131 mm, No. 27500, 113 mm, No. 27501, 135 mm, No. 27502, 131 mm, November 10, 1927; South Ubian Island, No. 14120, 71 mm, April 13, 1936; Sibaud, Lapak, No. 15617, 96 mm, No. 27458, 82 mm, No. 27459, 84 mm, No. 27460, 72 mm, No. 27461, 94 mm, No. 27462, 80 mm, November 8, 1927; No. 27445, 93 mm, No. 7446, 90 mm, No. 27447, 100 mm, No. 27448, 89 mm, No. 15757, 102 mm, November 8, 1927; Sibutu Island, No. 14068, 136 mm, No. 27449, 58 mm, No. 27450, 90 mm, No. 27451, 97 mm, No. 27452, 96 mm, No. 27453, 135 mm, April 27, 1926; No. 13722, 50 mm, No. 27442, 54 mm, April 26, 1926, No. 27440, 50 mm, No. 13693, 45 mm, No. 14066, 128 mm, April 27, 1926; Bungau Island, No. 13568, 122 mm, No. 27454, 83 mm, No. 27455, 49 mm, No. 27456, 91 mm, No. 27457, 90 mm, April 16, 1926, No. 11913, 73 mm, August 13, 1924, No. 14433, 155 mm, July 15, 1924: Davao Province, Samal Island, No. 3806, 70 mm, No. 3602, 75 mm, No. 3695, 130 mm, May 1, 1908.

HONOLULU, No. 27463, 140 mm.

MYRIPRISTIS SCHULTZEI Seale. Plate 5, fig. 1.

Myripristis schultzei SEALE, Philip. Journ. Sci. § D 4 (1909) 504–505.

Dorsal X, I, 15; anal IV, 13; pectoral 15; ventral I, 6; lateral line 28 to 30; transverse line 10.

Height 2.3 to 2.6; head 3 to 3.1. Eye 2 to 2.2, snout 7.5. Interorbital space about 3.3 in head; maxillary 1.80, posterior tip ending on a line with posterior margin of pupil, width of distal end about 2 in eye; pectorals 1.3. Ventrals 1.45 to 1.5.

Body oblong, somewhat compressed, greatest width at origin of dorsal. Upper and lower profiles of body about equal. Length of caudal peduncle 0.23 in head, its depth 3.2. Depth of head about equal to its length; interorbital space flat, with 4 longitudinal ridges. Anterior outline of head bent abruptly down in front of eyes, making a short blunt snout, the length of which is 2 in its width; maxillary reaching to below hind margin of eye.

Opercular bones denticulate, opercle with a single spine on its posterior margin, maxillary with small teeth on lower posterior border. Mouth large, oblique, lower jaw slightly longer, lower jaw with four distinct pores, two anterior front and two

at bottom of tip. Teeth in jaws, vomer, palatine, and on hyoid portion of tongue; two groups of four teeth each at tip. Gill opening very large, carried forward to below anterior margin of pupil. Gillrakers long, longest 2 in eye. Pseudobranchia present. Scales large, toothed; body fully scaled; head naked except about 3 rows of scales on checks. Fourth dorsal spine longest, 1.9 in head; anal and soft dorsal practically equal, anal rays a little longer. Origin of ventrals midway between anal and anterior margin of eye. Caudal forked.

Alcoholic specimens yellowish white with some bronze reflections, darker above; fins uniform yellowish white; no opercular blotch; inner axil of pectorals deep black.

Distribution.—Philippine Islands.

The above description is based on the type specimen, No. 3899, 128 mm, collected from Samal Island, Gulf of Davao, May 4, 1908.

MYRIPRISTIS PRALINIUS Cuvier and Valenciennes. Plate 5, fig. 2.

Myripristis pralinius CUVIER and VALENCIENNES, Hist. Nat. Poiss. 3 (1829) 170; BLEEKER, Nat. Tijdschr. Ned. Ind. 2 (1851) 234; 3 (1852) 262; GÜNTHER, Cat. Brit. Mus. 1 (1859) 20; SAUVAGE, Poiss. Madagas. (1891) 17; JORDAN and SEALE, Bull. U. S. Bur. Fish. 25 [(1905) 1906] 222; WEBER and DE BEAUFORT, Fish. Indo-Austr. Arch. 5 (1929) 253–256.

Myripristis seychellensis CUVIER and VALENCIENNES, Hist. Nat. Poiss. 3 (1829) 128, 129; SAUVAGE, Poiss. Madagas. (1891) 12.

Myripristis bleekeri GÜNTHER, Cat. Brit. Mus. 1 (1859) 20; BLEEKER, Ned. Tijdschr. Dierk. 4 (1873) 179.

Myripristis indicus BLEEKER, Ned. Tijdschr. Dierk. 4 (1873) 183; WEBER, Fische Siboga-Exped. (1913) 187.

Myripristis multiradiatus GÜNTHER, Fische der Südsee 1 (1873–1875) 93; JORDAN and EVERMANN, Bull. U. S. Fish. Comm. 23 [(1903 1905] 149.

Dorsal X, I, 17; anal IV, 15; pectoral 15; ventral 1.7; lateral line 36 to 40; transverse line 10.5.

Height 2.3 to 2.5. Head 2.75 to 3. Eyes 2.1 to 2.3. Snout equal to third of eye; interorbital space 1.75 of eye, one fourth in head; maxillary reaching to below hind margin of pupil, posterior edge with coarse distant spines, height posteriorly equal to half eye; tongue generally without teeth. Origin of dorsal separated by 8 or 9 scales from occiput; third dorsal spine longest, a little longer than diameter of eye, about twice as long as spine of second dorsal; third anal spine longest, equal to length of pectoral spine; pectorals equal to head without snout, longer than ventrals; ventral spine equal to diameter of

eye, about two times as long as pectoral; caudal deeply forked. Least height of caudal peduncle about two times in diameter of eye.

In life crimson red with golden reflection and with more or less distinct longitudinal bands on body, corresponding to rows of scales; lower part of scales rosy; opercular spot and base of pectoral dark brown, fins bright rose, dorsal, caudal, and ventral all edged with white; first dorsal deep red, paler at base.

Distribution.—Madagascar, New Guinea, Red Sea, Ceylon, Ireland, Samoa, East Indies, Philippines.

The above description is based on specimen No. 15693, 98 mm, collected from Mabohoc Point, south coast of Jolo, November 10, 1927.

LUZON, Sorsogon Province, Bacon, No. 3223, 128 mm, 1904. MINDANAO, Sulu Province, Mabohoc Point, south coast of Jolo, No. 27464, 83 mm, November 10, 1927.

ILLUSTRATIONS

[Drawings by A. Lagman. The scale given with each figure equals 1 cm, except that in Plate 4, fig. 1, which equals 2 cm.]

PLATE 1

FIG. 1. *Holocentrus sammara* (Forskål).
2. *Holocentrus opercularis* (Cuvier & Valenciennes).
3. *Holocentrus lacteo-guttatus* (Cuv. & Val.) M. Weber.

PLATE 2

FIG. 1. *Holocentrus ruber* (Forskål).
2. *Holocentrus cornutus* (Bleeker).
3. *Holocentrus violaceus* Bleeker.

PLATE 3

FIG. 1. *Holocentrus caudimaculatus* Rüppell.
2. *Holocentrus diadema* Lacépede.
3. *Holocentrus bleekeri* M. Weber.

PLATE 4

FIG. 1. *Holocentrus spinifer* (Forskål).
2. *Myripristis melanostictus* Bleeker.
3. *Myripristis murdjan* (Forskål).

PLATE 5

FIG. 1. *Myripristis schultzei* Seale.
2. *Myripristis pralinius* Cuvier and Valenciennes.

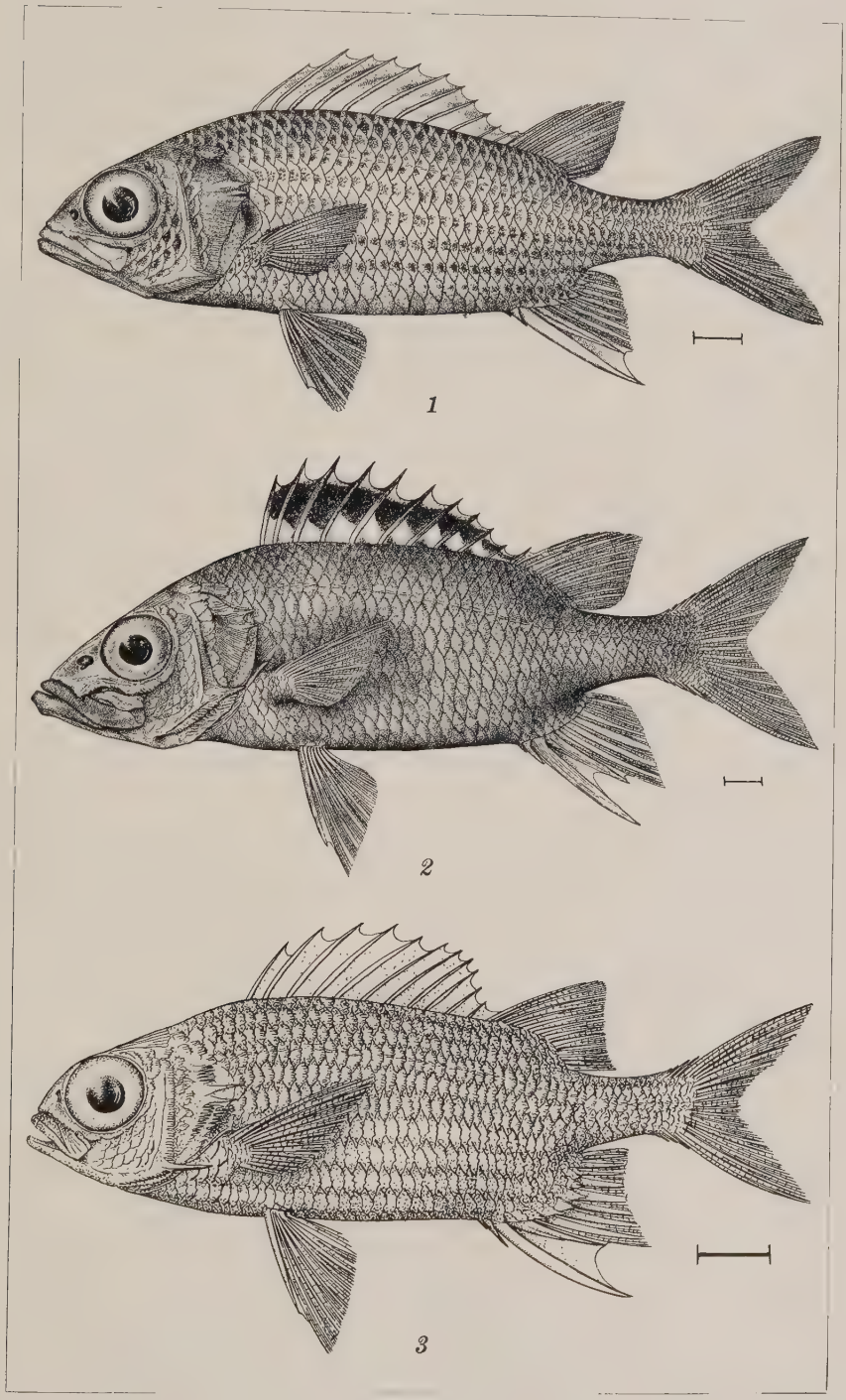

PLATE 1.

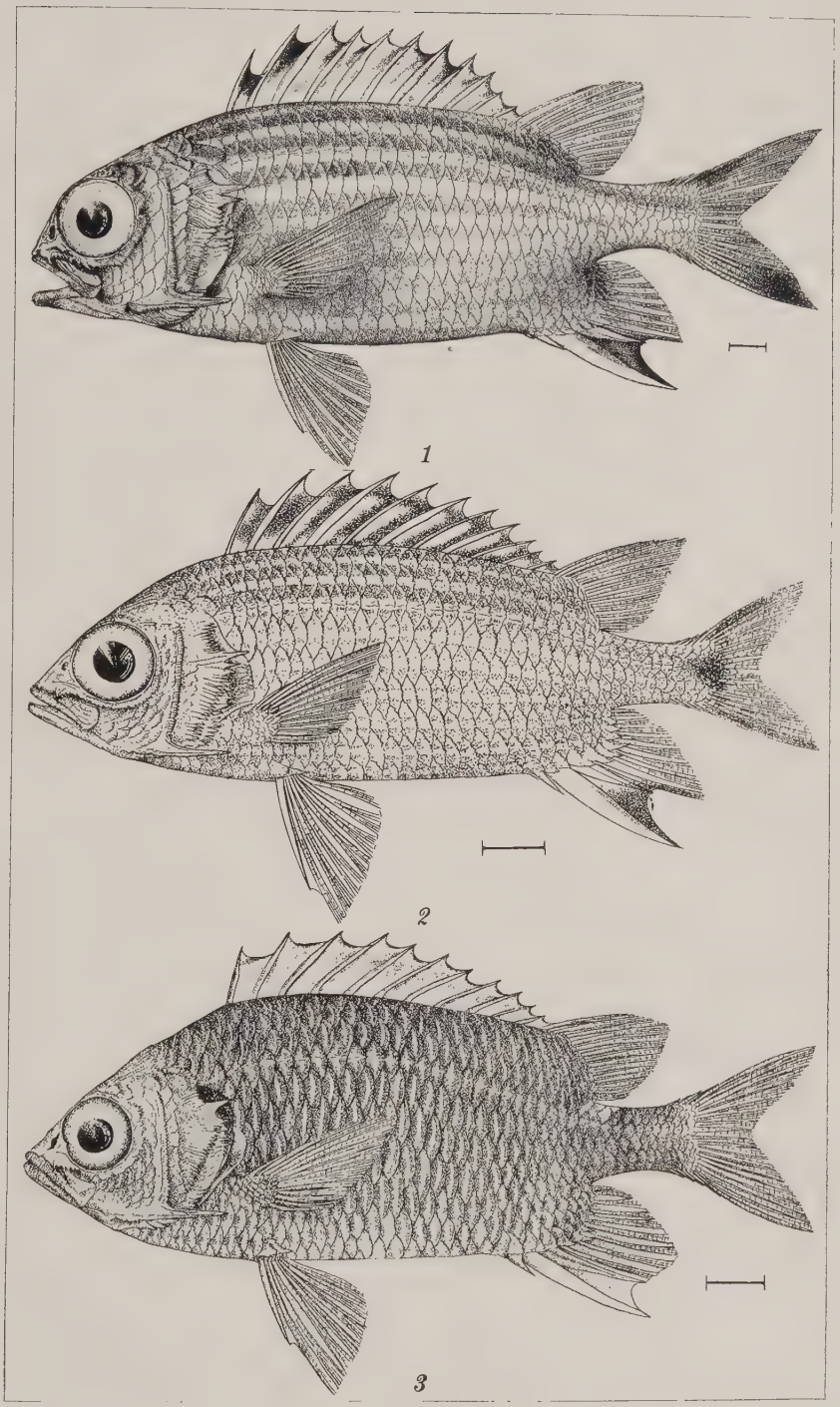

PLATE 2.

Strange Reptiles and Their Stories. By A. Hyatt Verrill. Boston, L. C. Page & Company, c1937. 195 pp., frontispiece, illus. Price, $2.50.

This book is intended primarily for youthful and adult readers interested in the general aspects of the subject, so that technical terms have been avoided and no attempt has been made to classify or arrange the reptiles in their scientific groupings. The interesting ways and habits of reptiles are featured. Selection has been made of the commoner and more noteworthy species and those of particular importance. Facts about these animals are given, to do away with many popular fallacies, and the strange and ridiculous beliefs and superstitions connected with them. Included are a number of narratives of personal experiences of the author, together with incidents and anecdotes of other well-known travelers, explorers, and scientists. Exceptionally good and quite accurate drawings of a good number of the reptiles included in the book serve as a guide in the identification of reptiles.

The book should prove of great interest and help to laymen, especially those who because of lack of scientific training would find treatises written in highly technical and scientific terminology difficult.—D. V. V.

Manual of Rubber Planting (Malaya). Compiled by A. T. Edgar. Kuala Lumpur, F. M. S., The Incorporated Society of Planters, 1937. 411 pp., illus. Price, $8 (Straits Currency).

This book presents a comprehensive guide for the convenience of rubber growers. It embraces all conceivable phases of rubber planting, manufacturing and shipment of rubber, and similar vital information on a number of subjects that rubber growers find very useful.

Part 1 deals with land tenure in the Federated Malay States; how to select rubber land, with descriptive sketches on the different types of soil and altitudes where rubber should be grown in Malaya; the opening up of an estate, including the clearing of jungle and cogonal lands, such as felling, burning, clearing, and the like; sites for buildings, such as factories and employees and laborer's quarters; laying of the land; soil conservation; selection, breeding, and propagation of planting materials; upkeep of young as well as old rubber plantations; manuring; control of pests and diseases; tapping and collection of latex; preparation of smoked sheets, spray, rubber, and crêpes.

Particular mention should be made of Sections 4, 5, 7, 8, and 12 of the manual, wherein the author discusses with thorough-

ness the advantages and disadvantages of budgrafting, the improved clones of Para rubber and the subsequent care of same, the high-yielding clones of which are now revolutionizing the rubber industry in Java, Sumatra, and Malaya. A list is given of clones that are suitable for planting in certain sections in Malaya. The author claims that the production of seeds by crossing is inadvisable on a commercial scale, due to the disappointment experienced by the planters in planting clonal seeds.

Section 7 discusses at length the tapping systems in vogue in Malaya, and the advantages and disadvantages of each on young as well as on old Para rubber trees. In Section 8 the names of the different pests and diseases attacking Para rubber are listed, including pointers on how to identify them in the field, together with the necessary control measures. In Section 12 the manufacturing of raw rubber, including the descriptions of smoke houses, the production of standard smoked sheets and crêpe and spray rubber; and the preservation and testing of latex for export purposes are clearly outlined in detail.

Part 2 embraces some notes on estate sanitation for planters and laborers, such as housing, the collection of waste, water supply, sewage disposal and purification, and the prevention of some diseases. This part of the manual includes also the first-aid measures necessary for snake and dog bites; labor conditions and laws; organization of coöperative societies; estate records; road making, construction of buildings; use of concrete, survey instruments, and equipment; and weights and measures and their equivalents, which are all essential in farm practice.

The manual would certainly be useful as a guide not only for the rubber growers or those contemplating to engage in this industry but also for the planters of other crops.—F. G. G.

Butter and Oleomargarine: An Analysis of Competing Commodities. By W. R. Pabst. New York, Columbia University Press, 1937. 112 pp. Price, $1.50.

The purpose of this book according to the author is to investigate the interrelationships of butter and oleomargarine "in the light of recent theoretical work and through the application of modern statistical technique."

The competition between butter and oleomargarine dates back to 1870, when an oleomargarine factory established in Paris started the commercial production of oleomargarine. The dairy industry, especially the production of butter, is being continually threatened by the competition of artificial butter made from

vegetable oil. By the end of the nineteenth century the oleomargarine industry had already established itself in the United States and offered stiff competition to the butter industry. Not all the oleomargarine produced in the United States at present, however, is manufactured by the oleomargarine industry; a substantial amount of this product is manufactured as a secondary product in the meat-packing industry and as a by-product in other industries.

Because of the keen competition of oleomargarine with butter, the dairy industry has been continually agitating for the enactment of laws that would restrain competition and handicap the producers of oleomargarine. Even during the latter part of the nineteenth century state laws were passed against oleomargarine, as a part of the legislation against fraud. The fraudulent sale of oleomargarine and its use in the adulteration of butter have greatly affected the butter industry, so that nothing short of a federal law was needed to establish fair competition between these two industries.

The increased consumption of oleomargarine during the World War has greatly stimulated the industry. The dislocation of agriculture in the United States was attributed partly to the oleomargarine industry, and there has been increased agitation on the imposition of high tariff on butter. The tariff on butter had also the effect of increasing the price of oleomargarine and indirectly benefited the manufacturers of this product. The use of coconut oil in the manufacture of oleomargarine has increased the opposition of the butter producers who claim that oleomargarine made out of coconut oil is a foreign product, and they resent the competition of the "Philippine cow" with the American variety.

Dr. W. R. Pabst, in Chapter III of this treatise, gives the very interesting relationship between butter and oleomargarine as competing commodities. The use of diagrams would have greatly improved the presentation of this aspect. The butter producers led by the National Coöperative Milk Producers' Federation are continually advocating the imposition of higher taxes on all kinds of oleomargarine as well as the imposition of an excise or processing tax on all imported fats and oils used in the United States. As a result of this agitation, coconut and other imported oils are now subjected to excise or processing taxes, and to taxes on oleomargarine containing foreign oils. In the Revenue Act of 1934 the United States imposed a tax of

5 cents on coconut oil coming from foreign countries and 3 cents on Philippine coconut oil. As a result of the imposition of this tax, cottonseed oil, which is a domestic product, is being used increasingly in the manufacture of oleomargarine. The effects of the tax on oleomargarine to equalize competition with butter cannot be determined accurately, and the author points out that it would tend not to equalize competition but to distort it further.

Those who have preconceived ideas about protecting the butter industry by imposing taxes and other restrictions on the manufacture of oleomargarine would do well to examine this important work on the subject. There is a good bibliography with court decisions at the end of the book.—A. V. C.

Ceramic Data Book Featuring Equipment and Materials Catalogs, Also Buyer's Directory. 10th ed. Chicago, Industrial Publications, Inc., 1938. 292 pp., illus. Price, $5.

As stated in the foreword, this book is "the engineering and purchasing handbook of the ceramic and clay products industries. It is published annually and distributed to all plants in these industries, with the sole purpose of placing accurate, up-to-date information before the operating executives in a handy and readily available form."

The book is divided into three sections. The catalog section contains the buyers' directory, and equipment and materials. The editorial section includes a review of important developments in the glass, enamel, whiteware, clay products, and refractories industries. The handbook and data section gives a compilation of tables, charts, definitions, and data that ceramic manufacturers and technologists have frequent occasion to use. The book has a detailed index at the end. The index to firms represented in the catalog section is at the front of the book. A list of books on the subject is given at the back.—F. D. M.

Qualitative Analysis and Chemical Equilibrium. By T. R. Hogness and Warren C. Johnson. New York, Henry Holt and Company, c1937. 417 pp., illus. Price, $2.75.

This book is an important addition to the long list of qualitative chemistry textbooks.

It gives a brief yet clear exposition of the properties of solids, liquids, and solutions which are necessary for the proper understanding of reactions in solutions. The schematic and graphical treatment of certain points, as polarity of molecules, law of mass action, and the like, is very effective. The emphasis on

chemical equilibrium and experimental technique involving the use of small quantities of substances fills the modern need in modern qualitative work for reorientation as regards subject matter and object. The procedure differs from the system of Fresenius only in that it starts with the soluble group.

The trend in analysis of using small amounts of materials should be welcomed, as it is conducive to rapid analytical work; also care and neatness in the carrying out of procedures. It still remains to be seen, however, whether the change from the micro- to semimicro technique is desirable for elementary courses.

The book may be suitable as a textbook for students who have taken a brief course, say a semester, of general chemistry.

—F. L. R.

Basic German for Science Students with Vocabulary and English Translations of the German Passages. By M. L. Barker. 3d. ed. Cambridge, England, W. Heffer & Sons Ltd., 1937. 186 pp. Price, 6s.

This book is primarily designed for "reading knowledge" of German or ability "to give in English the gist" of writings in German on scientific subjects. It appears that all that is required for this ability is knowledge of German grammar reduced to an "absolute minimum" and familiarity with "a vocabulary of approximately 650 of the first thousand basic German words."

Part 1 consists of general passages, with six introductory lessons and exercises covering the special "grammar" study regarded as necessary. The plan of each lesson is consistent. At the head of each lesson come a few verses from chapter 1 of Genesis, the first "general passage," with the German and English texts opposite each other on the same page. In the selection of the basic vocabulary from the verse passages the arrangement is identical in all lessons. First are listed nouns, then verbs, prepositions, adjectives, and miscellaneous words; the nouns are given with their articles in all forms and the verbs are classified and presented with their principal parts. The grammar is essentially functional, in that it is based on actual usage. Besides this functional grammar there is a section on "word order." At the end of each lesson is an exercise on vocabulary and grammar. Here the student is required to translate simple English sentences into German or to decline nouns with articles and attributes. The other general passages deal with the history of civilization. An English translation of each selection is given on the opposite page. These texts are selected from the standpoint of chronology, completeness, and interest. Professor

Barker believes that his general passages contain the required basic vocabulary or "those words which are actually of most frequent occurrence in the writings of the German people."

Part 2 is a collection of extracts of writings in German in the various scientific fields including chemistry, zoölogy, botany, physics, mathematics, and medicine. As in Part 1, the English translation of each passage is printed on the opposite page, and the basic vocabulary is collected at the foot of the page in the order of appearance in the text. In both Parts 1 and 2 the total number of basic German words listed is approximately 1372. It may be pointed out that the alphabetical glossary at the end of the book is much fuller than the listed "basic vocabulary."

On the whole, I believe, the book will serve its purpose. The method of selecting the basic vocabulary seems logical, and perhaps adequate. However, the sufficiency of the "reduced" grammar, I am inclined to think, is open to question. Though the points of grammar considered may be adequate as far as they go, still much may be lacking even for "reading knowledge." There is hardly anything on participial construction, and there is very little on sentence structure and word composition. Because of the conciseness of these forms, German scientists use them constantly in their writings. Familiarity with these forms is essential to a student who wishes to translate scientific German with facility and accuracy.

Finally the ready accessibility of the English versions of the texts may develop the line of least resistance in the student. Instead of stimulating learning, the English translation may entirely do away with the effort to learn, or induce the student to take too many things for granted. From a pedagogical point of view the "Appendices" containing German passages set in certain examinations given in English universities may result in greater learning power as exercises in retranslation. In my experience vocabulary building means constant use of the dictionary by the student.—E. N.

Wind-Pressure on Buildings. Experimental Researches. By J. O. V. Irminger and Chr. Nøkkentved. Translated from the Danish by Alexander C. Jarvis and C. Brødsgaard. First and Second Series. København, Denmarks Naturvidenskabelige Samfund, 1930, 1936. 2 vols., illus., plans, diagrams. Price, 20 Kr.

The first book contains records of experiments conducted on bodies subjected to air current in a wind tunnel designed for

the purpose. The descriptions of the apparatus used and the description of the tunnel itself, together with the necessary accessories and connections, are given in detail and with photographs. The results of pressure measurements made at different points of the models are given in graphical form. The various shapes subjected to air current consist of plane surfaces and solids. Circular discs varying in diameter from 50 to 70 cm and rectangles and triangles of various dimensions were used. Among the solids used were spheres varying in diameter from 50 to 100 cm, cylinders of from 6 to 40 cm diameter, and prisms, pyramids, cones, and cubes of different dimensions.

In the second book are contained studies on models of partly open buildings and of buildings without any walls, and screens with and without perforations which were subjected not only to air current produced in the wind tunnel but also to natural wind. The authors made stream-field measurements in addition to pressure measurements. Photographic records of stream lines around the models are given. An Appendix giving the mathematical treatment of the results of the investigations upon stream fields surrounding buildings is included.

With the exception of this mathematical appendix, the books can be easily understood by average readers.—C. A. O.

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